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The Jackson Lecture.¹

THE TREATMENT OF FRACTURES: AN HISTORICAL REVIEW.

By NEVILLE G. SUTTON, M.B., Ch.M., F.R.C.S. (Edinburgh), F.R.A.C.S.,
Honorary Surgeon to Out-Patients, Brisbane Hospital.

I WISH to express my appreciation of the honour done me by the Council of the Queensland Branch of the British Medical Association in appointing me to deliver the fifth Jackson Lecture, particularly as I find I am the first lecturer born in this State.

For those who do not already know it, I may state that this lecture was instituted by your

Council in 1931 as a fitting way in which to record their appreciation of the long and valuable services of Dr. E. Sandford Jackson to this Branch. Dr. Jackson was a foundation member of the Branch and has thrice been chosen to fill the office of President—in 1895, 1911 and 1926. Dr. Jackson has requested me to apologize for his absence tonight. He regrets that he finds it difficult to attend night meetings, and rather too much of a strain. I do not think I need go into details of the valuable work that he has done for us on many occasions; but, as you know, he has also devoted himself to the study of history, particularly the history of the discovery of Australia and of medicine in Queensland; and we owe him our gratitude for planting this seed of culture here, for the study of history is necessary for the attainment of the fullest and broadest conception of our professional life.

In the Old Country it has long been the custom to honour the men who have served medicine scientifically or culturally by establishing a lecture

¹ Read at a meeting of the Queensland Branch of the British Medical Association on August 30, 1935.

named after them, to be delivered periodically; but usually it is necessary that such a man should be dead for many years before his memory is thus recognized. In our young country of Australia we have but lately realized the eternal fitness of such a pleasant custom, but perforce we start the recognition earlier. It remained for the Queensland Branch to conceive the brilliant idea of honouring Dr. Jackson by such means whilst he is still in our midst. It was thus most fitting that the seed of historical study should be cherished by the stipulation that the Jackson Lecture be on the subject of medical history, so that at least once a year we can put aside the present and study the past; and I am sure that it will always prove profitable and usually, I hope, pleasurable.

As the late Just Lucas-Championnière said: "We too often forget, in our vanity of modern science, that during thousands of years before our day men have observed and meditated."

Tonight I have chosen to speak about the treatment of fractures down the ages, as I have long been interested in this branch of surgery, and I thought that a review of the most important historical facts in connexion with the development of our modern conceptions might prove of some interest. However, I must protect myself by warning you that, as I am attempting to cover a period of roughly five thousand years, I cannot pretend to be encyclopædic.

The most ancient records of the treatment of fractures are supplied by bodies found by the Hearst Expedition of the University of California excavating at Naga-el-dér, about one hundred miles north of Luxor in Egypt. They were described by Sir Grafton Elliot Smith in *The British Medical Journal* in 1908.⁽¹⁾

These bodies were found in rock-cut tombs which were identified as belonging to the fifth dynasty, which, according to the most conservative estimates, ruled in Egypt about 4,500 years ago, or perhaps somewhat before this, in the vicinity of 5,000 years ago, that is, 3,000 years before Christ. Two of these bodies had fractured limbs, with splints in position, and these are the oldest splints which have come to the light of day in any part of the world, and, with the exception of small flint instruments for use in circumcision, are the oldest surgical appliances ever discovered.

Two separate sets of splints were discovered, one applied to what was evidently a compound fracture of the femur in a girl about fourteen years old, and the other to a compound fracture of both bones of the forearm. In the former fracture four splints are applied round the circumference of the limb, they are roughly shaped of wood and about one foot four inches long and one and a quarter inches wide, and reach less than three inches above the site of the fracture, but about six and a half inches below the knee. Each of these splints is carefully wrapped in linen bandages wound round the wood in two layers obliquely, so that the obliquity of the superficial layer is at right

angles to that of the deeper layer. As Sir Grafton Elliot Smith remarks, these splints must have been useless to support the broken bone or prevent shortening; they could only fix the knee joint and afford some degree of rest to the injured limb. Examination of a series of healed fractures of the femur in Egyptian mummies showed, as could be anticipated from such treatment, that, as a rule, there was considerable shortening, displacement of fragments and excessive callus formation.

In marked contrast is the effective support afforded by the splints in the case of the forearm fracture, where again a more or less complete tube of splinting invests the limb from a point about an inch below the upper end of the radius as low as and partly including the wrist joint. This was constructed of three pieces of rough bark and a bundle of straw or coarse grass. A large series of healed forearm fractures showed excellent results following these methods of treatment as practised by the ancient Egyptian surgeons.

Hence we gather that from the dawn of historical record the principle of supplying an external support in the form of encasing splints, that is, an exoskeleton to replace the broken endoskeleton, was well established and could be carried to a successful result in certain regions of the body; but the more advanced problems of prevention of deformity in the case of fractured femur, where the action of large and powerful muscles is involved, were not appreciated, and even today these present considerable difficulty.

In prehistoric Egypt, that is, before the time of the first dynasty, or about six thousand years ago, fractures of the ulna alone usually healed with little or no displacement or shortening, probably on account of the splintage afforded by the undamaged radius. A fracture of both bones of the forearm, however, found in an early prehistoric grave in Nubia showed considerable displacement of both bones and also evidence which seemed to indicate that the fractures remained ununited for some time before eventually healing. This find was reported on by Professor Wood Jones, who worked in collaboration with Professor Elliot Smith in anthropological investigations in Nubia.

It is interesting to learn that fracture of the forearm—as a rule the left ulna, but often both bones and sometimes in both arms—has always been exceedingly common in Egypt in comparison with other fractures, which is true of every period from the earliest known prehistoric times up to the present. This is due to the indulgence of the Egyptians in fencing, both as an amusement and as a serious method of attack, for which purpose they use the "naboot", a very thick, heavy stick about five feet long. The great majority of these fractures were inflicted when the victim attempted to defend himself, or herself, by raising his bent arm.

It may be interesting here to contrast the treatment practised by a settled and highly civilized community, such as the ancient Egyptians, with

that of the nomadic and primitive aboriginal Australians. From the information I have received from Sir Colin MacKenzie,⁽²⁾ of the Australian Institute of Anatomy, I am able to state that there was no definite treatment recognized or adequate rest provided for aborigines with fractures.

Roth, who was himself a medical man, writing of the north-west-central Queensland aborigines, says:

With regard to fractured limbs, two to four sticks in the rough may be tied on a broken arm or leg and left there perhaps for from one to two months; the value of the remedy is rendered inactive, however, by the fact that these splints are not of sufficient length to keep the adjacent joints at rest. At other times, instead of splints, the limb may be wrapped up in opossum skins and tied tightly round and round with twine. The value of slings, crutches, etc., in these cases is unknown: if an arm is broken, it is supported by the hand of the opposite one; if a leg, the patient is carried to camp and left there.

Dr. Basedow also, in his "Anthropological Notes Made on the South Australian Government North-West Prospecting Expedition, 1903", writes:

For wounds of all descriptions a universal remedy is emu fat and ochre, which really appears to be a most effective application. Broken limbs they cannot "set". On several occasions natives were met with who had previously broken a leg. The bone had grown together again in a distorted and awkward position. The natives referred to limped very badly and used a stick to assist them in walking.

Thus it would appear that some crude attempts at treatment were made in some districts, but in others the patients managed as best they could. The results of such methods are well shown in a series of bones of natives showing healed fractures which are displayed in the Osteology Museum of the Australian Institute of Anatomy at Canberra. Some show the bones united in fairly good position, but in most there is union with gross overlapping or angular deformity.

In the Bible there is apparently but one mention of fractures, in the book of the Prophet Ezekiel, chapter xxx, verse 21, as follows:

Son of man, I have broken the arm of Pharaoh, King of Egypt; and, lo, it shall not be bound up to be healed, to put a roller to bind it, to make it strong to hold the sword.

The Prophet Ezekiel lived about 600 B.C.

Our next landmark is the classic period of Greek culture, when Athenian democracy reached its highest point of development; and there lived at this time Hippocrates, whose figure stands out for all time as the Father of Medicine. Living from 460 to 370 B.C., he had as contemporaries such men as Pericles, the statesman, Æschylus, Sophocles, Euripides, Aristophanes and Pindar, the poets and playwrights, Socrates, the philosopher, and his pupils, Plato and Xenophon, Herodotus and Thucydides, the historians, and Phidias, the sculptor, truly a brilliant company, whose names are familiar in every centre of culture today, which shows the mark they made on the history of the world.

Hippocrates himself, in his own sphere, was no less preeminent, and his influence in medicine lasted till the middle ages as almost a sacred authority.

He founded the bedside method of examination, the use of the senses and the mind as diagnostic instruments, applied his experience of past cases to the treatment of his patients, and left complete clinical records of individual patients.

He wrote⁽³⁾ on fractures and dislocations specifically, his books on these subjects being masterpieces and, considering the age in which they were written, the equal of any similar modern work, which is the considered opinion of such an authority as Sir Clifford Allbutt.

The study of his work is intensely interesting, and I could spend the whole evening on it alone, but I must curtail my remarks as far as possible; it is, however, important to give a fairly full outline, since, as I have already stated, it served as the model and highest authority, to be commented on, quoted and copied right up through the middle ages to the eighteenth century, that is, for over two thousand years.

He describes in detail the general principles of fracture treatment: first, reduction of the broken bone by traction and counter-traction, stating that in the case of the forearm less force is required than in the leg and thigh, where the muscles are more bulky and stronger. In the first one assistant may be able to exert the force necessary, in the second two strong men, whilst in the last two men may not be sufficient, and he advocates the use of special apparatus. One such for making extension and counter-extension by means of two windlasses at the ends of a stout beam placed under the patient is an instrument called the glossocomium. Another, the first description of an orthopædic table extant, is known as the scamnum of Hippocrates; and, although Hippocrates's works are not illustrated, subsequent commentators have illustrated it for us. Both these pieces of apparatus can be seen to be thoroughly practical, and indeed do not materially differ from such as are in general use today.

Whilst the extension is being exerted by such means, the surgeon places the bones into apposition with the palms of his hands. He also describes the correct posture of the limbs, stressing what he calls the natural position as that which can easily be sustained: the position of relaxation. For example, in the case of fractured forearms, the elbow should be flexed to a right angle, in a position midway between pronation and supination. For the lower limb the extended position is considered correct, as it can be maintained for considerable time with comfort. He points out the importance of reducing the fractures in such positions so that they will need no alteration when retentive appliances are being put on, as that would tend to upset the position of the broken bones again; in spite of the writings of MacKenzie and Hamilton Russell, the importance of this advice is not always appreciated to this day. He also states: "The model by which we judge if the part be properly set is the part which is its pair."

The limb was then bandaged with roller bandages; evidently both the skin and the turns of the

bandages were well smeared with cerate, a composition of wax and other ingredients which kept the roller bandages in place and somewhat stiffened them, making them like the modern starch bandage. The details of the application of these rollers are fully set out, and warnings are issued about the tightness, the increase in tension on the first day, and the expectation of relaxation on the second and third days, when they should be reapplied. Generally they were reapplied every three days until the seventh to eleventh day, according to the situation, when, the swelling having subsided and the parts relaxed, splints were applied over fresh rollers. The fractured bones were placed in position at each dressing and the part was bathed with hot water.

The splints are not described in any detail, but it is stated that they should be smooth, even, and rounded at the extremities; that they should be somewhat shorter all along than the upper bandaging; and that those parts where there are tuberosities, and which are devoid of flesh, such as the ankles or fingers, should be guarded from the splints which are placed over them, either by position or by their shortness. Directions are given as to the avoidance of pressure on bony prominences, which would cause decubitus or bed sores and gangrene; the patient should be closely questioned concerning the comfort of the limb, and if complaint is made the bandages should be removed and the parts inspected—advice which is of the greatest importance.

In the case of the leg and thigh he mentions gutters, and says that in the thigh it is necessary that they should reach from the nates to the foot, or should not be used; as a matter of fact he is quite undecided as to the advisability of this form of splint. He warns against backward sagging of the limb and other malpositions. Evidently the bandages applied with cerate in the first week were designed to maintain the reduced position, and they were to be tightly applied over the site of the fracture and more loosely at either end away from it.

But he does give a full description of an apparatus for compound fracture of the leg which is most interesting. It consisted of two rings such as those of a Thomas's splint, but smaller, one to bear below the knee, the other above the ankle; they are kept extended by a pair of rods of suitable length on either side.

He states the time necessary for the consolidation of the various bones, with the proviso that there is nothing precise in the matter: forearm bones take thirty days, leg bones forty, and the femur fifty—not so very diverse from the most modern teaching.

He makes but one reference to massage in this book on fractures, and, as it is rather wonderful, I will quote it, as translated, word for word:

Friction can relax, brace, incarnate, attenuate: hard braces, soft relaxes, much attenuates and moderate thickens.

From this you can judge his keen observation and accurate knowledge: soft massage relaxes (hence

Lucas-Championnière and Mennell), hard leads to spasm, moderate helps to increase the volume of the muscles. And he also states: "Exercise strengthens and inactivity wastes."

Hippocrates deals with compound fractures at some length and recommends the use of iron wedges or levers to reduce the fragments if necessary.

He discusses the exfoliation of bone fragments and states that when the bone of the arm or thigh protrudes the patients do not easily recover; and that if the fractures are reduced, convulsions usually supervene. Probably this is a reference to tetanus.

In another part of his writings he describes very fully fracture of the clavicle and its treatment. He distinguishes transverse and oblique fractures, and in the latter he describes the sharp projection upward of the inner fragment and shows how futile it is to try to keep it in place by pads and compresses fastened down by bandages to a girdle round the waist or passed under the perineum. He shows how the correct treatment is to elevate the arm, and so the shoulder and the acromial fragment attached thereto, so as to place the more movable fragment in line with the more fixed, and by suitable bandages to maintain it thus.

He states that a deformity, however, may arise and that in these cases the deformity is very great at first, but that by and by it becomes less. He also tells how, even when neglected, these cases do quite well and callus quickly forms. Fourteen days is considered sufficient time for the patient to be done up if he keep quiet in a recumbent posture, or twenty days at most.

He recommends also the use of gold thread round the teeth in fractures of the lower jaw, saying that if the teeth be distorted or loosened, when the bone has been adjusted they should be brought together, not only two, but more of them, with a gold thread if possible, otherwise with a linen thread, until the bone be consolidated.

Next we come to Celsus, who lived at Rome in the reign of Tiberius Caesar, in the lifetime of Christ. His eight books, "*De Re Medica*", form the oldest medical document which has been preserved intact after the time of Hippocrates, there being only fragments from the intervening four hundred years. There has been considerable doubt whether Celsus was really a medical practitioner or merely a compiler of books, but I see that a new translation of his writings has just been published, the work of Mr. Walter Spencer, of London, who is a strong advocate for the view that Celsus was an actual practitioner.

The eighth book⁽⁴⁾ deals with osteology, fractures and dislocations. He describes the difficulties of reducing fractures of the clavicle and methods of maintaining the reduction with pads and bandages and even a small wooden ferrule splint, not mentioned in Hippocrates.

He issues the general warning that bandages should be applied more frequently round the part (that is, with more turns) rather than too tightly,

"which is of itself a general rule in all fractures of the bones", an observation cribbed from the master, as indeed most of his statements are. But there are several important points which I cannot find mentioned in the older writings.

Referring to fractured clavicle, he says that if there be any spicule of bone, the skin should be incised over it and the ragged portion which wounds the flesh removed; then the bones should be brought together.

Another most interesting general observation is as follows:

Sometimes, however, the bones are accustomed to unite in an oblique direction, and the limb becomes shorter and deformed . . . for this reason the bones ought to be fractured again and again set.

He points out that fracture at the middle of the shaft of a long bone is much more favourable than fracture near the ends, and that the nearer the fracture is to the articular end, so much the worse it is; for it causes great pain and is cured with greater difficulty.

He is perhaps less skilful or more honest than Hippocrates in speaking of the results of treatment of fractured thighs, for he says:

We ought not to be ignorant, however, that a fractured thigh is shortened, because it never entirely returns to its former state; and the patient ever after supports himself on his toes on that foot, which occasions great weakness; but it is much worse when the misfortune has been caused by neglect.

Now Hippocrates said:

Nothing should be omitted in order that the parts should be properly distended and put in a straight line; for it is a great disgrace and injury to exhibit a shortened thigh.

But it is difficult to imagine that he obtained results without a few inches of shortening by the methods he describes, and I think he is writing of the ideal to aim at, whilst Celsus bluntly tells us of the usual results in practice. It is interesting to see this also: "the muscles and tendons which in the natural state are held on the stretch by bones are contracted when fracture with displacement has occurred"—one of the earliest observations on muscle tone. Finally, referring to compound fractures, he writes:

But if at any time the bones have not united, in consequence of the dressings being frequently removed, and the parts disturbed, the treatment to be adopted is obvious; for union may yet take place. If the fracture be of long standing the limb is extended, in order to produce a fresh injury; the bones must be separated from each other by the hand, that their surfaces may be rendered uneven by the grating against each other; and if there be any fat substance it may be abraded and the whole reduced to a recent accident; yet great care must be exercised lest the ligaments or muscles be injured.

This was written about 1,900 years ago, yet is very suggestive of one of the "modern methods" of treatment of delayed union by hammering over pads or drilling the bone ends.

The Hebrews attained the highest eminence amongst Oriental peoples in hygiene, as is evidenced

by the standards of the Talmud, whilst the Hindus excelled all other nations of their time in operative surgery, and there are Cingalese records of hospitals in Ceylon in 437 B.C. There are several Brahminical medical texts all written in the centuries after Christ, but founded on still earlier works, but the most remarkable is by Susruta, and it is a great storehouse of Aryan surgery written in the fifth century A.D. In it the treatment of fractures by means of a special splint made of withes of bamboo is described, and this was subsequently adopted in the British army in India as the "patent rattan cane splint". It is certain that when Alexander the Great came in contact with India in 327 B.C., in his long victorious campaign, the physicians and surgeons of these countries enjoyed a well deserved reputation for superior skill.

There were several prominent Greek surgeons in the first few centuries of the Christian era, but I cannot linger over them. However, I must mention Galen, A.D. 131-201, a Greek physician who practised at Rome, but also travelled much. He attained great eminence and wrote voluminously. He studied at Alexandria, at this time the centre of the medical world, and famous for its anatomical teaching, as dissection of the human body was actually carried on; this, however, was subsequently discontinued and was not revived till a much later period. Galen was rather a physician, but also practised surgery; he wrote a commentary on Hippocrates's writings and expanded them, and was famous for his works on pharmacy and his physiological experiments. I think he followed the Hippocratic teachings as regards fractures, and the added weight of his authority was largely instrumental in perpetuating these methods through the ensuing dark ages. The practice of these traditional methods, which had become established by the combined authority of Hippocrates and Galen, continued through the centuries that followed, carried on by Paul of Ægina, the Persian Haly Abbas, and the great Arabian surgeons, Avicenna (980-1036), Albucasis, Avenrhoes, and Avenzoar. The writings of these men are well summarized by Francis Adams in the Sydenham Society's edition of the "Seven Books of Paulus Ægineta", published in 1846, and there it can be seen how little they added to Hippocrates in the knowledge of fractures. Then arose in the eleventh and twelfth centuries the great Italian schools of medicine at Salerno, Bologna, Padua and Naples, and the French Universities of Paris and Montpellier. This was a period of temporary enlightenment; and associated with it are a group of famous surgeons who flourished in the thirteenth century, such as Saliceto of Bologna (1210-1277), who emphasized crepitus as a diagnostic sign of fracture; Henri de Mondeville, who lectured at Montpellier (1260-1320); Lanfranc of Milan (at the latter part of the thirteenth century); and Guy de Chauliac (1300-1370). There were glimmerings of a new spirit of inquiry and independence of thought, as is shown by the sarcastic remark made by Henri de Mondeville: "God did not exhaust all

His creative power in making Galen." At these schools dissecting of the human body, which had been previously rigorously proscribed by law and sentiment, became more and more a matter of course, and anatomy gradually became an exact science, culminating in the works of those giants of anatomical discovery and description, Vesalius (1514-1564), Fallopius (1523-1562), Eustachius (1524-1574), and Fabricius of Aquapendente (1537-1619), the last of whom was the teacher of the English physiologist William Harvey. But Fabricius, in spite of these recent discoveries, placed it on record that in surgical practice, and especially in the treatment of fractures, he was an implicit follower of Hippocrates and Galen. "Nor was the spell really broken for fully another hundred years.

This was the time of one of the most renowned of surgeons, Ambroise Paré (1510-1590). Paré studied and practised in Paris and, like so many famous men, served as a surgeon in the army, during which time he made his name and became the most famous surgeon of his day.

He introduced or revived many ideas into surgery, but his treatment of fractures does not materially advance the practice of Hippocrates and Galen, whom he frequently quotes, and I do not think that it is necessary to enter into a detailed discussion of minor points found in his works. However, he himself suffered a compound fracture of both bones of his leg,⁽⁵⁾ about four inches above the ankle, caused by a kick from his horse; and he vividly describes his sufferings and gives minute details of the treatment, such as the necessity for avoiding backward sagging or forward bowing of the fragments and pressure sores over the sacrum and heel. From his own mishap he evidently learnt much, and he invented a metal splint to place the fractured limb on and hold it in a natural position with a footpiece to control rotation and keep the coverings from touching the toes; there was also an opening for the heel to obviate pressure.

Richard Wiseman (1622-1672) was the leading English surgeon of the seventeenth century. He practised the method of Hippocrates "for keeping the parts of a fracture joined together and to defend them from inflammation". He, however, speaks of a fracture of the femur in a boy being successfully treated by an immovable apparatus constructed with whites of eggs and other ingredients, which is one of the earliest English references to the treatment of fractures by a cast.

It was thus not till the middle of the eighteenth century that surgeons began to think for themselves, and, to quote from a sixty-years-old discussion of the treatment of fractures by Sampson Gamgee of Birmingham,⁽⁶⁾ "the honour of protesting against the accumulated blunders of a faulty tradition, of rescuing this branch of surgery from unenlightened empiricism, belongs unquestionably to Percival Pott".

Pott (1714-1788) lived in London and was a surgeon at Saint Bartholomew's Hospital. In 1756

he sustained a fall in the street, and while confined to bed with a fractured leg he wrote a series of surgical masterpieces on hernia, head injuries, hydrocele, *fistula in ano*, fractures and dislocations, and his final most famous pamphlet on palsy from spinal deformity; the two last mentioned have given his name to the fracture of the region of the ankle with eversion and to the tuberculous infection of the spine.

It is an interesting and not generally known fact that the fracture which he himself sustained was a compound fracture of the tibia, probably the usual oblique or spiral type which occurs in the lower half of the bone, and not the fracture which now bears his name, which was indeed fully described by him, but quite impersonally.⁽⁷⁾

Pott insisted on the necessity for immediately reducing a broken bone and keeping it absolutely at rest; he taught that to secure this end splints must embrace the joints above and below the seat of fracture, and his knowledge of the physiology of repair of such injuries was no less advanced than his therapeutics. He said:

By the resistance of the muscles, and of these only, are we prevented from being always able to put the ends of a fractured bone immediately into the most apt contact.

He advocated putting the limb which had sustained a fracture in such a position as would relax the muscles so as to maintain reduction.

At this time Germany had not established its claim to surgical distinction and the schools of Italy were declining, so that Paris and London disputed the palm for surgical supremacy.

In France, Petit and Desault advocated continuous extension, and they were followed by Boyer, Dupuytren and Delpech, the last the pioneer of orthopaedic surgery in France; all of these lived at the end of the eighteenth and beginning of the nineteenth century.

In England at the same time practised Pott and Cheselden, and they were succeeded by Sir Astley Paston Cooper and John Bell, of Edinburgh, the latter of whom advocated a well-framed case, stiff, adapted to the shape of the limb, stating that:

There is more of gentle uniform resistance than could be derived from these torturing machines . . . and much greater than can be procured by that cruel extension which Desault has decorated with the fine title of permanent.⁽⁸⁾

Larrey (1766-1842), the greatest French military surgeon of the time, who served in the Napoleonic wars and was created a baron for his service, devised a method of fixing the whole limb in a solid casing (composed of compresses, bandages and straw cushions soaked in a mixture of camphorated spirit, acetate of lead, and white of eggs beaten up with water) which, whether the fracture was simple or compound, was not removed until the period required for the consolidation of the bones had expired. And let it be said he got some very good results.

The method of treating fractures by encasing the limb in a more or less solid case must be of

extremely ancient origin; it must surely appeal to the most uneducated to be a common-sense procedure to support a broken endoskeleton by applying a temporary exoskeleton, and a cast is the most perfect form of this. That this view is more or less correct is shown by the fact that there are various reports of such methods of treating fractures being used by peoples with primitive civilization.

One writer stated that the ancient no less than the modern Greeks employed a permanent apparatus, which was applied soon after the receipt of injury and which, with perfect security, enabled the patient to move the limb in any direction; for the purpose of consolidating the apparatus, which was not removed from the moment of its application to that of perfect cure, a composition into which mastic largely entered was used.

Similarly an English surgeon, Sir George Ballingall,⁽⁹⁾ said:

The practice of enveloping fractured limbs in splints and bandages, without undoing them for weeks together, is akin to that followed by the natives of India, of enclosing fractured limbs in moulds of clay. Of the successful result of this practice I remember a remarkable instance in the case of a little boy who was brought into my tent one morning, having been run over by a wagon in the line of march, and having sustained a severe compound fracture of the leg. I was preparing to amputate the boy's limb when his parents came in and carried him away to the potter in an adjoining village, who enveloped the leg in clay and, I believe, finally cured the patient.

Dr. Paperi,⁽¹⁰⁾ an Italian, writing to Professor Barzellotti, of Sienna, in 1821, states that among the nomadic tribes in the interior of the kingdom of Tunis, it was customary to treat fractures of the limbs with plaster and mortar, just as walls are repaired.

Thus it would appear that the origin of the use of plaster of Paris was somewhere in the East. Charles Creighton, in the *Encyclopædia Britannica*,⁽¹¹⁾ states that the use of plaster of Paris bandages and other immovable applications for simple fractures were old Eastern practices and were recommended for use in Europe in about 1814 by the English Consul at Basra.

The Belgian military surgeon Antonius Mathijssen (1805-1878), is credited with the idea of impregnating the bandages with plaster of Paris and then bandaging them on, in 1852, and his friend J. H. P. Van der Loo popularized their use and improved the casts so that they were lighter and could be cut down to permit of examination of the fractured member.

Plaster of Paris casts were used for fractures during the Crimean War (1853-1856) by the Russians under the leadership of their great surgeon Pirogoff, and this considerably added to their reputation.

In Germany their use had been consistently advocated by Dieffenbach (1792-1847) and his successors, and plaster splints were very successfully employed by them in the Franco-Prussian War of 1870-1871.

Jean Louis Petit, in the early part of the eighteenth century, advocated the use of pasteboard splints, which, when wet, could be moulded accurately to the parts, and on drying they became firm enough to retain in position all kinds of fractures, even the most difficult; and, following him, they were much used in France and later in England to the middle of the nineteenth century.

In about 1834 Louis Joseph Baron Seutin introduced starch bandages for the treatment of fractures, and they had considerable vogue.

There are not many specific fractures that are widely known by their eponymous designation, but it is a remarkable fact that two that are thus known probably throughout the greater part of the world were both described by Dublin professors of surgery. I refer to Colles's fracture of the lower end of the radius, which was described in 1814 by Abraham Colles, and Bennett's fracture or stove of the base of the first metacarpal bone, described by Edward H. Bennett in 1881.

Then there came on the scene the great man of surgery of all time, who so changed the outlook of operative and wound surgery that new conceptions arose in all its branches. Lord Lister, born in Essex in 1827, employed his antiseptic method in the treatment of compound fractures first in 1865 with complete success, and in 1867 published his results. Although he met with much antagonism and apathy, by their scientific presentation and the greatness of their truth, his views prevailed and surgical operations became safe and certain procedures, freed from the previously ever-present fear of sepsis.

Lord Lister⁽¹²⁾ published in 1871 a report of a lad with a fracture of the middle of the shaft of the ulna with forward dislocation of the head of the radius of many weeks' standing. Lister cut down on the site of fracture, divided the bone, and resected the head of the radius with a perfectly successful result, the wounds pursuing the normal aseptic course and the lad gaining a completely useful arm. In the ensuing few years Lister operated on many ununited and malunited fractures with equally good results, among them being ununited fractures of the neck of the femur, of the lower end of the femur, of the olecranon and the patella. In 1877 he operated on a fractured patella fourteen days after the accident, drilling the fragments with a common bradawl and wiring them together with stout silver wire. The joint was drained and the convalescence was without incident and the healing perfect. Eight weeks after operation the silver wire was removed. Thus Lord Lister laid the sure foundations for the immediate operative treatment of simple fractures.

At about the same time a French surgeon, Lucas-Championnière, conceived an entirely new idea in the treatment of fractures by massage and mobilization. As this was rather a revolutionary method and its influence on the treatment of fractures was so great, we should examine some of his principles rather closely.

He first stated that movement not only failed to hinder, but rather favoured bony union, a conclusion drawn from his personal observation on untreated cases and compound fractures which necessarily had to be moved to be dressed. He sought to combine the needful movement with other means of improving the vitality, circulation and innervation of the parts, and so combined mobilization with a special form of massage which, as you all well know, is a slow, gentle, rhythmic stroking of the limb. This exerts a soothing influence on the patient and the muscles of the injured part and relieves the muscular spasm and thus reduces the deformity. It also leads to the maintenance of functional activity of the whole limb, and it is in this respect that we owe so much to Lucas-Championnière and his ardent advocacy of his methods for fully forty years. He taught the medical profession the immense importance of preservation of function and the correct attitude to adopt toward fractures, which is not to be obsessed with the break in continuity of the bone, but to regard the injury to the limb as one to the whole mechanism of motion. Although at first he was rather radical in his views, his final attitude was not to dispense with retentive apparatus entirely; he admitted its use in most cases, but stated: "As soon as there is no fear of displacement take off all splints." However, in all cases he used daily movement.

But many of Lucas-Championnière's propositions were based on false premises, and it is important to note this to see why his methods have not been universally adopted. I will enumerate some of these to show you my meaning. He said: ⁽¹³⁾

It is a mistake to suppose that the exact restitution of the length of a limb is the essential condition for the restoration of muscular power and usefulness to the limb. My observations have shown me that some shortening is favourable, rather than the reverse, to muscular efficiency.

And:

Fracture of a long bone rarely allows of perfect juxtaposition of the fragments.

And finally:

A good illustration is fracture of the clavicle, where all useful reduction is prevented by contraction, and for which all sorts of apparatus have been fruitlessly employed.

The underlying inaccuracy of such statements must be apparent, and Lucas-Championnière, in spite of his great work on fractures, accepted the necessity for imperfect reduction by the methods in vogue and made the best of a bad case, and so did not, as it were, attack the problem at its source. The statement about fractured clavicles I can personally refute at any time.

His principles of treatment have been ably carried on in England by Mennell, his great admirer, and it must be admitted that they have been on the whole a great improvement on previous methods.

Just at the end of the nineteenth century there was another scientific discovery which was of outstanding importance in medicine, and particularly so in the treatment of fractures; I refer to the

discovery of X rays by Röntgen in 1895. The practical application of X ray photography, or radiography, was quickly appreciated and, of course, it was to fractured bones that it was first and most readily applied. This must have much disturbed the peace of mind of surgeons treating fractures, as they now had a photographic record of the position of the fractured bones and of their efforts to secure reduction, and I am sure in most cases they received a shock to their pride in their professional skill.

Radiography also discovered certain fractures which previously had been unsuspected or only imperfectly described; a typical example of this is the fracture of the carpal scaphoid, which occurs with relative frequency.

It is certain that radiography gave origin to some of the remarks of Lucas-Championnière quoted above, and also to the direct attack on the bone by open operation developed in England by Arbuthnot Lane and in Belgium by Lambotte, ⁽¹⁴⁾ who laid down the principles of fracture treatment as: (i) to renew the anatomical form of the fractured bone, (ii) to move at once the articulations to avoid articular stiffness and atrophy, thereby combining anatomical reposition with the preservation of function stressed by Lucas-Championnière.

Lane, in fixing the bones with the plates which bear his name, gave to the medical profession the perfect aseptic technique variously described as the "non-touch" or "knife and fork" method of operating, in which nothing but sterilized instruments, not even the gloved hand, is allowed to enter the wound—the recognized precautions necessary for perfect healing in dealing with clean bone cases today.

The method of continuous extension which I have already referred to as being developed in France mainly by the hands of Desault, had been carried on and brought to the point of a ruling principle in the treatment of almost all fractures by Bardenheuer ⁽¹⁵⁾ in Germany, who used not only longitudinal extension, but also lateral and rotational pulls, applied by means of adhesive plaster strips. In 1907 Steinmann published the method of skeletal traction by means of a nail driven through the bone, the lower end of the femur, head of the tibia, *os calcis* or olecranon, as the case might be.

Thus it was that all these methods were being strenuously advocated by their individual exponents when in 1912 the British Medical Association thought the time ripe for an investigation into the treatment of simple fractures and appointed a special committee for this purpose and published their report in *The British Medical Journal* of November 30, 1912. ⁽¹⁶⁾

The report showed that a great deal of care and time had been devoted to the collection and classification of fracture statistics. I do not, however, intend to bore you with details, but to quote one or two general conclusions which stand out boldly as of the utmost importance.

They wrote:

An analysis of all the results, non-operative and operative, clearly shows the interdependence of the anatomical and functional result. The total number of cases in which a good anatomical result was obtained is 1,736, and in no less than 1,576 of these the functional result was also good. In other words, if the anatomical result be good, the functional result is good in 90.7%. If the anatomical result be moderate or bad, the functional result is good in 29.7% (i.e., 380 out of 1,279). If the anatomical result be bad, the functional result is bad in 53.3% (176 out of 330).

And from these results they conclude:

The most certain way to obtain a good functional result is to secure a good anatomical result. No method, whether non-operative or operative, which does not definitely promise a good anatomical result, should be accepted as a matter of choice.

These results have been well summarized by Hey Groves,⁽¹⁷⁾ who says:

The restoration of good form to a broken bone gives a chance of 9 to 1 in favour of a good function, whereas the allowance of a bad form will give a chance of more than 2 to 1 (7 to 3) against a good result.

No sooner was the report published than Sir Robert Jones, of Liverpool, gave a presidential address on the "Present Position of Treatment of Fractures",⁽¹⁸⁾ in which he discussed it fully. He then said:

There are several reasons why we do not meet with infinitely better results than are recorded in the report.

And he briefly summarizes some of these as follows:

We should be carefully taught the principles governing the reduction of fractures and their correct fixation.

We should not be out and out adherents of an operative, a fixation or a mobilizing school.

The value of correct alignment in conjunction with complete obliteration of shortening should be appreciated.

There are several special types of fracture which he particularizes, and for which he lays down the correct methods of treatment, stressing the treatment of fractures above the elbow joint in flexion and supination and by avoiding too early movements, the complete reduction of Colles's fracture and Pott's fracture of the ankle, and the use of the Thomas splint in fractures of the thigh and leg.

If I may digress for a moment, this paper served to bring the Thomas splint prominently before the notice of the medical profession, who had hitherto rather neglected it, although it was well known and used in Liverpool since its original description by Hugh Owen Thomas, the uncle of Sir Robert Jones, in a paper entitled "Diseases of the Hip, Knee, and Ankle Joints, with their Deformities: Treated by a New and Efficient Method", published in 1875. He was a master of the art of orthopaedic surgery and a whole-hearted believer in rest for inflamed and diseased joints, and he also introduced the treatment, so ably advocated later by his nephew, of fractures above the elbow joint by slinging the wrist under the chin in a "gauge-halter".

Then came the Great War, and, although most of its fracture problems were in respect to compound

fractures, it served to popularize the Thomas splint throughout the world as an instrument of the greatest utility. It also gave the death blow to the use of plates in compound fractures, and from then on their popularity in all types of fractures has steadily declined.

The War also emphasized the vast importance of maintaining or restoring function to damaged limbs and gave a great impetus to all forms of physical therapy.

The name of Meurice Sinclair deserves mention for his perfection of the technique of the use of Thomas's splint in fractured femur and of the means of applying extension by foot pieces glued on by flannel strips.

Sinclair, on the basis of his war experience, has become an ardent advocate of continuous extension in all fractures, and has written a book advocating his views.

It was also on the basis of war experience that the latest prophet in the brilliant array I have already mentioned founded his work. I refer to Lorenz Böhler, of Vienna, who in the last five or six years has aroused attention all over the world by his exposition of the treatment of fractures. Now Böhler occupies a unique position for the purposes of the study of fractures, as he is the Director of the Vienna Accident Hospital, which is maintained by the Accident Insurance Organization of Vienna for the treatment of all their cases.

He has developed many new and original methods which are proving of the greatest use; for this I can personally vouch, since I have been applying his principles for the past three to four years. His book was first published in 1929⁽¹⁹⁾ and has recently been retranslated. He lays down the following fundamental laws for the treatment of bone fractures.

The quickest and best way of making a fractured extremity again capable of function, consists in the proper reduction of the dislocated fragments, in prevention of atrophy of the muscles, and in the avoidance of progressive stiffness of joints.

The following fundamental rules must be adhered to:

(1) The peripheral fragment must always be placed in the direction where the central one points.

(2) Every fracture must be reduced by means of traction and counter-traction.

(3) After the reduction the fragments must be kept continuously in the right position until firm union takes place.

Later he says:

By functional treatment we understand the complete uninterrupted fixation of the fragments in good position with the simultaneous active movement of all the joints, or as many as possible, and with the avoidance of any pain.

His dictum in respect to fractures involving joints is to some quite unorthodox, but is really not new, and I believe it to be true.

If we reduce exactly a broken joint and continuously hold it in a good position until union takes place, and at the same time allow the use of the fractured extremity, we obtain a movable joint, while on the other hand, if we apply massage and passive movements in the first days after the fracture the joint becomes stiff.

Now in 1910 that enlightened surgeon, the late Hamilton Russell, of Melbourne, when discussing with considerable doubt the methods of Lucas-Championnière, said:⁽²⁰⁾

In fractures involving joints the most potent cause of stiffness is the so-called passive movement performed by the surgeon. Immobilization is never a cause of stiffness. The maximum degree of permanent usefulness is to be obtained by immobilization alone.

To put into effect these principles, Böhler has originated or popularized various procedures and appliances, and I shall mention the main ones briefly. First he uses local anaesthesia on all possible occasions by direct injection into the extravasated blood at the fracture site.

He uses manual traction with counter-traction by means of an arm sling in the upper limb, but if this is not sufficient he uses mechanical screw traction by means of Steinmann's nails or Kirschner wires inserted through the bones, and in difficult cases leaves them *in situ*. He uses plaster of Paris splints without any padding, that is, plaster to skin, and although this may seem to the uninitiated to invite pressure sores, if you pause to think, you will realize that it does just the opposite, as, fitting perfectly, it distributes the pressure over the whole skin surface, and in fact it is the only form of plaster in which patients can walk comfortably when applied for fractures of the ankle.

Strict precautions are, of course, taken to guard against and watch for the swelling apt to occur in the forty-eight hours succeeding reduction of the fracture. He has also designed a splint for fractured clavicle, which I referred to previously when criticizing Lucas-Championnière, and this really does maintain the fracture in perfect position when it has been reduced. Thus it is that I regard Böhler's methods as the high water mark of fracture treatment, as he details really efficient methods of securing and maintaining anatomical reduction and at the same time preserving functional activity of the parts.

But I would not be so foolish as a prominent surgeon at the end of the last century, who declared that the art of surgery had reached its zenith and he could not conceive of any improvement; rather would I side with old Henri de Mondeville, of six hundred years ago, and think that the future will have its great men, who will continue the advance, for, though life be short, art is eternal.

Acknowledgements.

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ACUTE BONE INFECTIONS INVOLVING JOINTS.¹

By G. KEITH SMITH, M.B., Ch.M. (Sydney), F.R.A.C.S.,
Honorary Assistant Surgeon, Royal Alexandra
Hospital for Children, Sydney.

It is generally considered that the infection of a joint by direct spread, from a focus in a long bone, is an occurrence of some rarity, and it can be conceded that the epiphyseal cartilage acts as a resisting barrier to the invasion of a joint by this means. This is a fortunate provision, in view of the fact that so many bone infections in children and in adolescents have their starting point in the neighbourhood of the epiphysis.

One has to bear in mind in this connexion that, on account of the varying anatomical factors met with in the skeleton, suppurative processes will also vary in regard to their behaviour and in the nature of their spread. In other words, much depends on the architecture of the joint, and more particularly on the situation of the epiphysis in relation to the joint capsule and synovial membrane.

Let me briefly refer to some of these varying anatomical arrangements met with in a few of the more important joints in so far as they have a definite bearing on the behaviour and spread of disease.

In the hip joint, for example, we have to remember that the capsule is attached to the neck of the femur anteriorly along the intertrochanteric line, but posteriorly it crosses the middle of the femoral

¹ Read at a meeting of the New South Wales Branch of the British Medical Association on July 25, 1935.

ILLUSTRATIONS TO THE ARTICLE BY DR. G. KEITH SMITH.



FIGURE I.
S.G. Osteomyelitis, severe grade, commencing near the acetabulum. The head of the femur has become dislocated upwards.



FIGURE II.
R.J. Illustrating metastatic joint infection two weeks after the blood had become sterile on attempted culture. Note the wandering femoral head.



FIGURE III.
R.J. A further lesion with minor febrile disturbance. Osteomyelitis of the humeral diaphysis involving the elbow joint. The picture illustrates the possibility of this involvement, as the lower end of the humerus is intracapsular.



FIGURE IV.
N.W. Osteomyelitis of the upper end of the humerus, not involving the shoulder joint.



FIGURE V.
H.L. Osteomyelitis of the patella, the knee joint being intact.



FIGURE VI.
R.B. Osteomyelitis of the femoral diaphysis. The knee joint is intact according to the radiological picture, although there is complete absence of movement, owing to adhesion and periarticular matting.

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neck; that is to say, the whole of the anterior surface and the medial half of the posterior surface of the femoral neck lie within the capsule.

In the knee joint, although the line of attachment crosses the epiphyseal line on the lateral and medial condyles, posteriorly it practically coincides with the epiphyseal line. The lower diaphysis of the femur and the upper diaphysis of the tibia may therefore to all intents and purposes be regarded as extracapsular.

In the ankle joint remember that the line of capsular attachment extends on to the neck of the astragalus, which is thus intracapsular, and consequently a source of danger to the joint in an infection of this bone. In the shoulder joint the line of capsular attachment crosses the epiphyseal line in such a way that the medial part of the diaphysis is intracapsular. And, lastly, in the elbow joint it is important to note that the distal extremity of the humerus is intracapsular. A focus here, though extrasynovial, exposes the elbow joint to involvement.

It will be readily admitted, then, that there are many situations in the bony structures in which a thrombo-phlebitic focus may lodge in that part of a bone entering into the architecture of a joint, and that any joint infection that follows is secondary to the focus in the bone.

Anatomically, several possibilities present themselves, depending, as stated above, on the relationship of the focus in the bone to the joint capsule and the reflection of the synovial membrane. In some of the cases the local focus in the bone lies altogether outside the joint interior; in others it may lie partly outside and partly inside the joint, or it may lie altogether within the joint. This relationship is, of course, especially important in epiphysitis.

It is by the process of direct spread, therefore, owing to anatomical conditions, that we have a ready, if not the most frequent, means by which a joint may be involved.

Secondly, a joint remote from a focus in a bone may become infected by organisms carried to it by the blood stream. Such secondary metastases are more often met with during the acute stage of an osteomyelitis with septicæmia, but I have at times been puzzled to observe them in the low grade stage, when organisms have long been absent from the blood.

A third type of joint involvement is one that is frequently seen during the course of an osteomyelitis. In this type an effusion takes place into a neighbouring joint, and this effusion nearly always subsides with the retrogression of the primary lesion. It is suggested that these effusions are due to an infection brought to the joint *per medium* of the lymphatics, and while they never arrive at the bacteria-carrying stage, it is possible that they partly contribute to loss of mobility that is occasionally met with as an after-effect. An associated peri-arthritis, with its sequelæ, is, I

believe, a more important contributory factor in the causation of subsequent disability in joints of this type. The knee joint, with its dense fibrous surroundings, appears to be an ideal one for the formation of periarticular adhesions following upon a disturbance of this variety.

Lastly, it may be as well not to lose sight of the fact that it is possible for both bone and joint to be affected simultaneously by two separate foci.

The Clinical Picture.

It is very difficult to enunciate a group of symptoms that would be characteristic of these cases, as the appearances and signs may vary widely, depending on the relation of the lesion in the bone to the general infection (septicæmia). In a low grade type of infection signs and symptoms of a joint involvement may be present without the clinical signs of a bacteraemia, though the existence of a previous transient bacteraemia is conceivable. In another type of case a focus in the bone, of low grade virulence, may have been in existence for some time, yet when rupture takes place into the joint the condition becomes one of severe grade, with profound toxæmia and symptoms dominated by the joint infection. The true nature of these cases may be easily overlooked at operation and the presence of the initial focus in the bone escape detection on account of the monopolizing symptoms and signs of arthritis.

The intensity of the infection may vary from one of low grade virulence through all the degrees of severity to a condition of profound and overwhelming blood intoxication, in which localizing signs may be lost or not demonstrable. Clinically, moreover, the presence of an infective focus may become almost a negligible factor, and the few organisms derived from this source play no very important part in the maintenance of the septicæmia, which at this stage depends more on the high virulence of the infecting organism and the low resisting power of the subject.

In this variety of case, then, the local focus of infection does not figure prominently in the production of the clinical picture, and these cases may come to operation or autopsy in the very early stages of joint destruction. The severity of the infection also does not always seem to bear a direct ratio to the amount of bone destruction, and I have noticed wholesale damage to joint surfaces in cases of low virulence. It is to be noted also that cases in the one group may at any time pass into another, either up or down in the scale of virulence.

Signs.

As previously mentioned, signs are liable to be masked in a profound intoxication, but it is safe to rely on the classical findings generally associated with any joint inflammatory lesion, that is, the characteristic posture of the limb and limitation of movement in all directions.

Treatment.

The management and treatment of these cases, some with an ever-changing clinical picture, offer many problems and call for no small amount of courage and restraint.

Many factors have to be taken into consideration, including the mechanism by which the lesion was produced and the nature of the associated osteomyelitis or epiphysitis. As a general rule it is safe to say that in those cases without profound intoxication or demonstrable blood infection conservative or expectant treatment should be adopted.

In the low grade type of osteomyelitis complicated by acute rupture into a joint, clinical manifestations, fever *et cetera* are entirely due to the joint complication, and as such do not necessarily call for a departure from the attitude of conservatism. The requirements can be met by immobilization and traction, and the issue may be left to the natural protective and healing powers in the body. Skilled nursing and suitable diet are, of course, necessary adjuncts. Of the various forms of internal medication that have been tried, I do not know of any that have particular value. In the event of operation being called for by localized tension or suppuration, the procedure would amount to simple incision and drainage.

Under this *régime* it is claimed that patients frequently recover in a satisfactory way with little or no loss of function. I have to confess that in the cases that I have met I am not able to point to many brilliant recoveries, and that even in mild infections the amount of bone destruction and subsequent loss of motion have frequently been a source of disappointment.

A patient with a neglected low grade type of infection may find his way to hospital only after rupture of the joint, and cases of this type occasionally make diagnosis difficult by presenting us with a swelling at a point remote from the joint itself. For instance, suppuration in the knee joint, after perforation, tracks downwards posteriorly and gives rise to a swelling in the calf. In the hip joint rupture takes place to one or other side of the ilio-femoral ligament or it may perforate posteriorly. In each instance a swelling appears in a different situation. When rupture takes place on the inner side of the Y-ligament, the abscess points over the pubic ramus. If on the outer side, pus will collect and spread over the outer aspect of the thigh. Occasionally the hip joint perforates through the acetabulum. In these circumstances operation is practically always necessary, and should consist of evacuation of the pus and drainage of the joint by a suitable method.

So much, then, for treatment along conservative lines, by which it is claimed that bone destruction may be limited and subsequent function partly or wholly restored.

The presence of a blood infection, however, indicates an urgent condition which demands early surgical intervention. It is to be borne in mind

that the focus is acting as a feeder to the septicæmia; and the longer the septicæmia continues, the greater is the danger from septic endocarditis or damage to other organs.

The first consideration, therefore, is the eradication of the focus of osteomyelitis or epiphysitis, though I do not intend at this stage to enter into a discussion on the surgical treatment of osteomyelitis. The ideal, if it could be attained, would be a radical extirpation of the focus; but this is often an impossibility, if only for anatomical reasons. Furthermore, it is not often possible at this stage to derive valuable information as to the extent of the mischief in the bone, either from the naked eye appearances at operation or from the X ray examination.

Joints, when infected, should be opened and drained according to the requirements of the particular joint.

In the more severe types of infection amputation may have to be considered as a means of saving life, though one is rarely faced with this problem in children.

In the severest types of fulminating septicæmia, occasionally met with, when the local lesion appears to be but an incident in the disease, operation seems to be quite futile.

The natural reparative powers of children, however, are notorious, and we are often confounded by recovery in seemingly hopeless cases. It is at this stage that distortions and deformities supervene so rapidly, and it is disconcerting to be confronted with dislocations and other difficulties in a child that one fully expected would die.

The orthopædic-minded might suggest now that some mention might have been made of immobilization or traction apparatus as an important part of the treatment in preventing deformity. It is very unpleasant to stand by and watch the head of the femur slip up on the *dorsum ilii* while the thigh assumes flexion and adduction or secondary deformities ensue in a contracted knee, all for the lack of a little traction.

Nevertheless, in actual experience in profoundly ill children the application of corrective apparatus is not practicable, and one is often powerless in preventing the severest of distortions from taking place. Later, when the condition of the child permits, efforts should be made to prevent or to limit deformity by suitable means, though frequently by this time destruction of joint surfaces has been sufficient to admit another child to the ranks of the permanently crippled.

A few words in reference to the treatment of that type of joint lesion referred to earlier: Might we call it a near infection or a sympathetic joint? There is danger here of subsequent stiffness, though, as mentioned previously, I believe that this stiffness is due mainly to periarticular adhesions and matting of tissues. I have tried early mobilization without success, and feel that attempts at mobilizing these joints are futile while there are any signs of active disease or sinus formation.

MECHANICAL ARTIFICIAL RESPIRATION.¹

By H. WHITRIDGE DAVIES,
Professor of Physiology, University of Sydney.

ARTIFICIAL respiration is necessary to tide patients over periods of temporary respiratory paralysis, partial or complete, in a variety of pathological conditions. In some cases the paralysis is prolonged over a period of hours, days, weeks or months and the ordinary manual methods of Schafer, Silvester *et cetera* become impossible, not only on account of the difficulty of organizing relays of operators, but also on account of the pain and trauma inflicted upon the patient. Thus in discussing a communication by Drinker *et alii*,⁽¹⁾ Dr. W. R. Redden states that even after one hour artificial respiration by the Schafer method became intolerable. In a case of Landry's paralysis it was maintained for twenty-eight hours, the victim remaining conscious and suffering great discomfort and later intolerable agony.

In order to overcome these difficulties a variety of mechanical methods for artificial respiration have been devised. These will be briefly described.

A. The first method comprises various types of "pulsator", in which a close-fitting mask is applied to the patient's face and his lungs are rhythmically inflated by means of either a pump or by the intermittent admission of gas under pressure from a cylinder. This latter method is incorporated in some types of gas-oxygen anaesthesia apparatus, for example, that of McKesson. The Foregger⁽²⁾ apparatus is of this type. Although a useful asset in gas-oxygen anaesthesia, this method has definite dangers of pulmonary over-ventilation and its use by various life-saving organizations has been largely abandoned.

B. The second is the rocking method of Killick and Eve.⁽³⁾ In this method the subject is strapped face downward on a stretcher which is pivoted near its centre. As the patient is rocked up and down, the diaphragm, with its underlying viscera, alternately falls away from and towards the chest. In a normal adult it was found to give a lung ventilation of nearly nine litres with 10 to 12 rocks per minute. It is possible also that this method may to some extent assist to overcome circulatory stasis, although by the methods they used, Killick and Eve were unable to demonstrate any significant circulatory changes in normal subjects. A pulmonary ventilation of nine litres per minute would be excessive in most cases, so that a rate of 6 to 8 rocks per minute seems more suitable, with a further reduction in rate if the return of spontaneous respiration be delayed. It is interesting that some time ago my colleague, Professor Henry Priestley, independently suggested an apparatus of this type. (Personal communication.)

¹ This paper embodies and expands some preliminary remarks made on the occasion of a demonstration of the Drinker apparatus at the Royal Alexandra Hospital for Children on May 28, 1935, during a post-graduate course of lectures.

C. The third method is that of the Bragg-Paul pulsator, which was originally designed for a patient suffering from progressive muscular atrophy. It consists of a rubber bag, with an inextensible outer covering, resembling an enlarged sphygmomanometer cuff. This encircles the lower part of the thorax and is rhythmically inflated and deflated

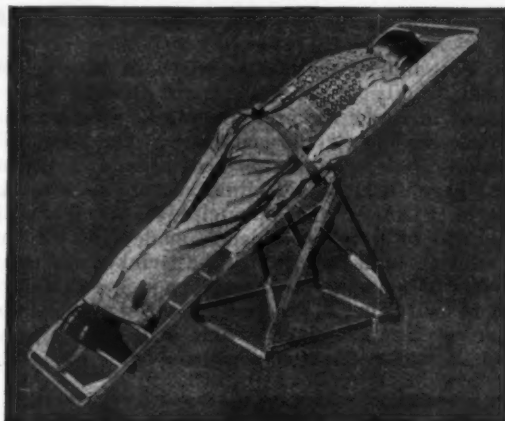


FIGURE I.
Apparatus for the rocking method of Killick and Eve. (Reproduced from "Oxygen and Carbon Dioxide Therapy", by Campbell and Poulton.)

by means of a concertina-like bellows operated either by an electric motor, by hydraulic power or by hand. The gradual development of the apparatus from the first improvised form and its use for over two years on the original patient are described by



FIGURE II.
The Bragg and Paul pulsator. (Reproduced from "Oxygen and Carbon Dioxide Therapy", by Campbell and Poulton.)

Mrs. Kerridge.⁽⁴⁾ Complete details of the apparatus are given in a recent paper by Paul.⁽⁵⁾ It allows of gentle uniform pressure over a much wider area than is possible with any manual method, and consequently brings much less trauma and discomfort to the patient. It also affords the minimum interference with nursing arrangements and with

mobility in a patient not completely paralysed. It will be observed that in this method expiration is brought about actively by compression of the thorax, while inspiration occurs passively by elastic recoil. An apparatus of this type could be readily improvised with the aid of an air cushion, a binder, a length of rubber tubing and an ordinary pair of domestic bellows. The inlet valve of the bellows should be blocked and the apparatus worked by hand or by foot.

D. The fourth method consists in placing the patient wholly or partly in an airtight box or chamber in which the pressure can be altered. This method was first described by Doe in 1889 (*Boston Medical and Surgical Journal*, Volume CXX, page 9), but his original account is not available in Sydney. The principle is used in the apparatus of Drinker, which is made in two forms, for adults⁽⁵⁾ and infants.⁽⁶⁾ The Drinker apparatus consists of a metal tank large enough to hold the patient with head protruding through a rubber collar set in a port-hole at one end. The original experimental apparatus permitted wide variations

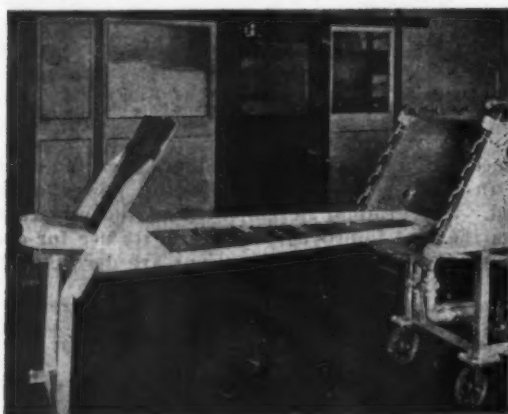


FIGURE III.

Drinker's respirator, open. (Reproduced from "Oxygen and Carbon Dioxide Therapy", by Campbell and Poulton.)

of rate (from 10 to 40 per minute) and of pressure from approximately *minus* 60 centimetres of water. Subsequently it was found that a negative pressure of from 6 to 10 centimetres of water was sufficient to expand the chest. In spastic cases higher pressures may be necessary, but usually the spasm can be overcome by other means. Thus in cases of tetanus or strychnine poisoning the spasms might be relieved by chloroform, and in cases of tetany from over-ventilation or of rigidity in carbon monoxide poisoning by 5% carbon dioxide. The negative pressure in the apparatus is produced by means of a powerful suction fan operated by an electric motor. A valve operated by a separate motor is opened rhythmically and allows the pressure within the apparatus to rise to atmospheric pressure. In case of a failure of electric current the apparatus can be operated by means of a hand bellows. The cost of the apparatus is considerable.

With all methods of artificial respiration, whether mechanical or manual, the question of the adequacy of pulmonary ventilation demands consideration. Quantitative investigations indicate that the tendency is towards excessive rather than deficient ventilation. This, as Killick and Eve⁽³⁾ rightly point out, would lead to excessive elimination of carbon dioxide and so delay the recommencement of spontaneous respiration. This point is well illustrated by some figures obtained in an experiment conducted by Dr. F. S. Cotton, A. D. Gillies and myself (Table I).

TABLE I.

Time (minutes).	Respiratory Minute Volume (litres).	Respiratory Rate (per minute).	Tidal Air (cubic centimetres).	Remarks.
0-1	10.2	15	680	} Schafer method
1-2	7.6	15	507	
2-3	6.7	15	447	
3-4	4.5	11	409	} Natural breathing
4-5	6.5	12 (?)	542 (?)	
5-6	6.5	13	500	

In this experiment artificial respiration by the Schafer method was performed by a student, who was a trained member of a surf life-saving club, on Dr. Cotton at a rate of 15 per minute. It can be seen that during the first minute of artificial respiration the lung ventilation was excessive, but, in spite of uniform pressure by the operator, and presumably owing to the Hering-Breuer reflex, it showed progressive diminution during subsequent minutes. On cessation of artificial respiration there was a considerable diminution in lung ventilation before it returned to normal. Killick and Eve⁽³⁾ found that with the rocking method a rate of 15 per minute caused excessive ventilation, and recommended a rate of 10 or 12. Apart from the physiological apnoea or reduced respiration already mentioned, there are at least two other ill-effects brought about by elimination of carbon dioxide in excess of its metabolic production. The first is increased stability of oxyhaemoglobin, so that, although the blood may contain a normal amount of oxygen, it is given off less readily to the tissues. This condition has been termed "secondary oxygen lack" and occurs in any type of "anoxic" or "anaemic" oxygen lack in which the elimination of carbon dioxide is unimpeded. The second ill-effect is a diminution in circulation rate, possibly a protective reaction to prevent undue alkalinity of the tissues which would result from excessive removal of carbonic acid. It seems desirable, therefore, that artificial respiration, however applied, should in many cases be accompanied by the administration of carbon dioxide (5%) and oxygen or air (95%). By this means the return of spontaneous respiration would be expedited and the risk of acapnia, with its attendant evils, circulatory deficiency and secondary oxygen lack, avoided. Failing this, in cases in which the return of spontaneous respiration is delayed, the rate should be diminished to ten, eight, or even six per minute.

Clinical experience would doubtless suggest a considerable number of pathological conditions with temporary respiratory paralysis of central or peripheral origin in which mechanical methods would be valuable. The following list must therefore not be regarded as complete.

1. In epidemic anterior poliomyelitis excellent results have been obtained in tiding patients over the acute stages in cases in which the nerve supply of respiratory muscles has been involved. In cases with bulbar involvement the results have been less satisfactory. (Drinker *et alii*.⁽¹⁾).

2. In narcotic poisoning, post-anæsthetic respiratory failure and alcoholic coma the treatment should be supplemented by carbon dioxide (5%) and oxygen.

3. In carbon monoxide poisoning, in all but the mildest cases carbon dioxide (5% to 7%) and oxygen (93% to 95%) are essential. Manual artificial respiration is usually adequate, but mechanical methods may occasionally be useful.

4. In electrocution prolonged artificial respiration is sometimes indicated. MacLachlan⁽⁷⁾ reports a case in which recovery occurred after eight hours. Other measures, such as intracardiac injection of adrenaline, the use of quinidine and the administration of carbon dioxide and oxygen, might also be necessary.

5. For *asphyxia neonatorum* the Drinker apparatus has been installed in a number of maternity hospitals in the United States of America. Cases have been recorded in which spontaneous respiration has commenced after one or two hours of mechanical artificial respiration. In these cases carbon dioxide with oxygen is a very valuable adjuvant.

6. Progressive muscular atrophy and other types of paralysis. In the former condition the Bragg-Paul apparatus has proved successful over a period of years.

7. In drowning, mechanical artificial respiration would be seldom necessary and less seldom available.

Possibly to some extent, on account of wide publicity in the lay Press, the Drinker apparatus enjoys a considerable vogue. In 1931 Drinker⁽³⁾ reported that there were seventy adult size and twelve infant size machines in use in the United States of America. Since then the number has doubtless increased. There are at present at least two in Australia. But the apparatus is expensive and cumbersome. Also the patient must be brought to it. Local experience with the apparatus has been not altogether satisfactory. Dr. Steigrad, of the Royal Alexandra Hospital for Children, states in a personal communication that in cases of poliomyelitis, in the early stages children are terrified by the machine, and that in the more advanced and serious stages the results have been disappointing. It would, however, be unfair not to point out that in the United States of America the apparatus is widely used and that such unsatisfactory results

have not been reported. Yet it seems that for practical purposes an apparatus of the Bragg-Paul type in most cases offers definite advantages, being portable and relatively inexpensive. It also allows more readily the application of other therapeutic measures, such as supporting splints, hypodermic medication *et cetera*. Nursing arrangements can be carried out without the necessity for interrupting the artificial respiration. Finally, in all cases urgently demanding resuscitation the paramount considerations are maintenance or restoration of respiratory and circulatory functions. The timely application of manual artificial respiration and other restorative measures is in most cases likely to be of far greater value than more elaborate appliances at a later stage.

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Reports of Cases.

PROGRESSIVE POST-OPERATIVE GANGRENE OF THE SKIN.

By H. H. SCHLINK and E. F. THOMSON,
From the Royal Prince Alfred Hospital, Sydney.

FORTUNATELY progressive gangrene of the skin is an extremely rare wound complication. It has received little or no attention in surgical text books. Several surgeons in America and Europe have recorded cases, mostly occurring after appendiceal abscess operations, but Christopher⁽¹⁾ reports a case following rib resection for empyema, Freeman⁽²⁾ one following an operation for gallstones, and Tennant one following an operation for ventral hernia. The case reported herein followed a drainage operation for puerperal cellulitis of the left parametrium, the site of the incision being above Poupart's ligament.

In the cases reported in the literature available in Australia the condition has almost always originated within a week or two of operation for drainage. The infection generally starts in part of the healed wound or a stitch hole as an indurated red area, tender and intensely painful, and advances with temporary remissions and exacerbations, the fully developed gangrenous

process appearing as a central black slough surrounded by an undermined and indurated red inflammatory zone with an underlying yellowish pussy base covered with soft and soggy granulations. The process is usually limited to the skin and subcutaneous layers, the deeper structures being spared. The gangrene is accompanied by a swinging temperature from normal to 38.9° C. (102° F.) daily, but the patient does not suffer from much general toxæmia and experiences only exhaustion and lack of sleep from the severe pain.

Most authorities agree that the causation is a combination of a non-hæmolytic streptococcus and staphylococcus. Brewer and Meleney⁽⁴⁾ and Meleney⁽⁵⁾ demonstrated that these organisms, when separately injected into animals, failed to produce any ulceration, but that in combination they reproduced the lesion. They therefore claim that the etiological factor is a symbiosis of these two infecting agents. Cullen⁽⁶⁾ in his case, however, found only a *Streptococcus brevis*, Christopher a Gram-positive coccus and a Gram-negative bacillus, Shipley⁽⁷⁾ a non-hæmolytic streptococcus alone, Mayeda⁽⁸⁾ an organism resembling a diphtheria bacillus, Cole and Heldeman⁽⁹⁾ an amœbic organism, Freeman a confusing multitude of organisms, and Smith⁽¹⁰⁾ the Klebs-Löffler bacillus (this was cured by antitoxin, and so this type of gangrene hardly comes under the lesion being discussed). Scotson's case⁽¹¹⁾ and our case lend support to the symbiosis theory of Brewer and Meleney. In none of the cases reported nor in our case was there any evidence of any underlying disease, such as syphilis or diabetes. All are agreed that the only treatment available is excision with the diathermy cautery of the entire inflamed and necrotic area well clear of the area of infiltration. No other local measure has any influence on the process which proceeds in an ever-enlarging area till its advance is checked by the above means. Baker and Terry⁽¹²⁾ also report an appendiceal case cured by excision with electrocautery. Holman⁽¹³⁾ describes four cases of phagedenic ulceration in which treatment was carried out by excision with electrocautery and maggot therapy, the methods being used either separately or in combination.

Clinical History.

E.W., aged twenty-nine years, married, with one child aged twenty-one months, was admitted to the Royal Prince Alfred Hospital on December 12, 1934.

The patient had been delivered of her first baby in a private hospital twenty-one months previously. Confinement was uneventful and the labour of twelve hours' duration, but on the ninth day of the puerperium she was attacked by a pain in the left groin extending up to the iliac region and down the left leg. She ran a temperature, but returned to her home after three weeks in hospital. The pain did not improve and the fever continued. After five weeks at home she was admitted to the Royal Hospital for Women, where after ten days' palliative treatment, a ten centimetre (four inch) incision was made between the spine of the pubis and the anterior superior spine of the ilium, five centimetres (two inches) above Poupart's ligament, a drainage tube being placed in the outer end of the wound. The whole of the wound broke down and opened, the edges were scarlet, and induration extended for a considerable distance beyond. After thirteen weeks in hospital the patient returned home, the sloughing wound gaping about five centimetres (two inches). The tube was pushed out and the edges of the wound were intensely painful and developed small undermining abscesses which gradually ate away the skin and superficial fascia, the aponeurosis retracting and exposing the internal oblique, which displayed a sinus at the site of the internal ring and extending internally towards the iliac fossa. All the time the patient had a temperature up to 38.9° to 39.4° C. (102° to 103° F.) with morning remissions. The patient states that soon after her return home fæces discharged through the sinus and the discharge of flatus was fairly constant. It again discharged fæces two months before her admission to this hospital. The sinus and wound continuously discharged a copious yellow pus, and the surface wound extended in all directions by peripheral abscess formation and necrosis of the skin, superficial

and deep fascia, the aponeurosis of the external oblique retiring in sympathy and exposing an extensive granulating area of internal oblique muscle.

Previous treatment had consisted of vaccines, sera, every known antiseptic lotion, sunlight, fresh air and sitz-baths, as well as stimulating tonics and diet.

On her admission to the Royal Prince Alfred Hospital the patient stated that amenorrhœa had existed since the birth of her child. Her general condition was fairly good, considering that she had been in bed and with a constant evening temperature up to 38.9° C. (102° F.) for sixteen months. Beyond a slight pallor, there was little evidence of profound toxæmia, and she had lost very little weight. Vaginal examination revealed a small, well involuted, movable uterus, slightly retroposed; there was no evidence of thickening or induration in the fornices, and only a slight amount of leucorrhœa existed. Nothing abnormal could be felt *per rectum*. The pregnancy had been her first,



Figure showing gangrene of the abdominal wall.

and she had never been seriously ill before. She complained of intense pain, mostly centred around the edges of the wound ulcer. The wound ulcer was of irregular outline and covered an area as large as a dinner plate. It extended from the pubic spine across the middle line to within five centimetres (two inches) of the umbilicus. From here the edge travelled to about five centimetres above and beyond the anterior superior spine of the ilium, then descended over the iliac crest to the groin, the lower edge being several inches below Poupart's ligament. The edges were undermined and sloughing all round, but extended into a deep cave below the *mons veneris* and the upper part of the left labium at the lower inner angle, and into another cave at the outer upper angle beyond the anterior superior spine. The base consisted of greyish granulations covering the exposed internal oblique, Poupart's ligament, Scarpa's triangle and the *tensor fasciæ femoris* beyond the iliac crest. About the position of the internal ring there were two sinuses separated by a bridge of muscle and leading into the iliac fossa. At the site of the external ring there was a projection of grey pussy granulation tissue the size of a brussels sprout.

The whole surface oozed a thick creamy pus which was greater in amount under the undermined edges and poured copiously from the two sinuses.

A series of investigations was made. A blood count revealed the following:

Erythrocytes, per cubic millimetre ..	4,320,000
Hæmoglobin value	60%
Colour index	0.69
Leucocytes, per cubic millimetre	9,700

No organisms were recovered on blood culture. The Wassermann test gave no reaction. The result of a kidney efficiency test was normal. No abnormality was found on X ray examination of the pelvic bones; neither did X ray examination reveal evidence of tuberculosis. A barium enema was given and X ray examination revealed no abnormality.

Wound cultures were made and examined. The organisms isolated were *Streptococcus hæmolyticus*, *Streptococcus viridans* and *Staphylococcus aureus*; the cultures were made on human blood agar. Anaerobic cultures of streptococci were also obtained. There was no evidence of streptothrix actinomycetes, *Entamoeba histolytica*, the Klebs-Löffler bacillus or the tubercle bacillus. Some weeks later cultures were made by Professor H. K. Ward and one of us (E.F.T.), and these showed a *Streptococcus viridans* both aerobically and anaerobically. These cultures were made on horse blood agar.

Treatment.—Eusol, iodoform emulsion, argyrol, Bonney's blue, copper sulphate (1 in 200 irrigations and dressings) were tried and found wanting. Exposure to sunlight and the exhibition of iodides proved useless. Immuno-blood transfusion, immunizing the donor with the organisms isolated from the ulcer, and iron per os were given whenever the blood picture deteriorated. Once it was at as low a level as the following:

Red cells, per cubic millimetre	3,500,000
Hæmoglobin value	54%
Colour index	0.77
White cells, per cubic millimetre	10,800

On May 9 it had recovered as follows:

Red cells, per cubic millimetre	4,190,000
Hæmoglobin value	60%
Colour index	0.72
White cells, per cubic millimetre	10,400

Operative Measures.—On December 14, 1934, the patient was given gas and oxygen and the wound was explored. Several peripheral pockets of pus were opened and the two discharging sinuses were thrown into one by dividing the bridge of tissue between them. This opening was then explored by the finger, which, after passing through the muscle wall, which gripped the finger like a sphincter, fell into a cavity beyond the size of a cricket ball. This was filled with soft grumous granulations and was bounded on the inner side by the sigmoid, above by the lower pole of the kidney, and externally by the iliac cup of the false pelvis. A large quantity of this soft, bleeding, granulated tissue was removed and iodoform emulsion and a gauze drain were inserted. Some excessive granulations were removed and a disorganized lymph gland was taken away from the region of the saphenous opening. Dr. Geoffrey Davies, pathologist, reported that it was a semi-necrotic gland with areas of fibrosis and hyaline degeneration. After this operation the amount of suppuration lessened considerably and the sinus discharged much less.

On February 1, 1935, under gas and oxygen anaesthesia, the cavity was again explored and found to have contracted considerably and the walls bounding it were much firmer. A large amount of soft friable granulation tissue was again removed and a stab wound was made into the upper part of the cavity from the loin just above the crest of the ilium. A tube was inserted with the object of irrigating the cavity. This proved very useful. The irrigating fluid, being delivered through the loin tube, flowed out of the sinus and so allowed thorough cleansing each day.

On March 29, 1935, under gas and oxygen anaesthesia, the cavity was again explored. Much friable material came away, but it was greatly reduced in size, being little larger than a walnut, and the walls were tough and well defined. The resident medical officer had taken out the loin tube the previous day and was unable to reintroduce it, so a finger was passed down the track and a tube was placed in again.

Present Condition.—The amount of suppuration has greatly diminished and very little pus comes from the sinus. The tube in the loin has been left out for the past two weeks. One or two small peripheral abscesses on the wound edge have ruptured after considerable pain. The projection of granulation tissue at the site of the external ring has disappeared through treatment with pure copper sulphate, and altogether the wound looks much better. The general condition of the patient is being maintained.

It is now proposed to cut away the whole of the undermined boundary of the wound ulcer with the diathermy knife. This procedure has been delayed on account of the profuse discharge coming from the internal abscess cavity through the old sinus. Until this was controlled it would have been stationary for some time. Professor Ward suggested the use of zinc peroxide, 25% paste, which is being prepared at the chemistry department of the University. Professor Dew suggests immuno-transfusion in addition to the cautery excision.

Conclusion.

This is undoubtedly one of those rare cases of progressive post-operative gangrene of the skin caused by a symbiosis of organisms (*Streptococcus hæmolyticus* and *Streptococcus viridans* and *Staphylococcus aureus*). It is in a site not previously described and is complicated by a persistence of the infection in the deeper internal tissues. In most of the cases described the deeper tissues recover quickly and only the skin and superficial and deep fascia become chronically involved.

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Reviews.

GYNÆCOLOGY.

THE fourth edition of Eden and Lockyer's "Gynæcology" is the first to be edited and revised by Beckwith Whitehouse, and the result is an excellent, clear and well written text book.¹ Two new chapters have been added, one on the physiology of the female sex organs, and the other entitled "Gynæcological Diagnosis".

The anatomy of the pelvic organs is extensively described and well illustrated, with a short chapter on embryology. Too much space is probably devoted to comparative physiology, but the section dealing with pituitary and ovarian hormones and endocrine therapy is clearly written and is a good summary of the present position of this rapidly changing subject.

Lipiodol injections into the tubes are considered to be not without danger and only suitable for institutional cases, an opinion opposite to that held by most American authors. Gas insufflation, however, is thought to be of definite value, but again only when performed in hospital. Artificial insemination—a method of conception in certain cases of sterility of which more will probably be heard—is shortly discussed, and the modern methods of contraception are described. The treatment of gonorrhœa in women is not very fully discussed. Similarly the *Trichomonas vaginalis* is quickly dismissed; apparently no adequate method of dealing with this troublesome condition has been evolved. No mention is made of the influence of endocrine anomalies on vulval irritation.

We gather that the authors are in favour of vaginal hysterectomy in many cases, with which we cannot agree. We are of the opinion that abdominal hysterectomy gives us an opportunity of observing the pelvic and abdominal organs and of detecting a pathological condition which would probably be missed by the vaginal operation. The mortality rate is not made less by the vaginal operation; in the hands of the general practitioner we venture to suggest that it would be increased. Worrall's broad ligament needle is not used for vaginal hysterectomy alone, as seems to be implied.

An open mind is recommended concerning the origin of endometrioma, a careful microscopic study of the epithelium is advised to differentiate between true endometrioma and blood or "tarry" cysts of the ovary. King's work in this connexion is rather quickly dismissed by the authors. We were pleased to note a strong recommendation for total as against subtotal hysterectomy, the latter being used only in certain selected cases in virgins and *nulliparae* with no signs of cervical infection.

An excellent chapter is that on the radio-therapy and surgical treatment of cervical carcinoma. The two methods are contrasted and some statistics are given of surgical treatment consisting almost entirely of that of Victor Bonney, "a surgeon of very great experience over a number of years". We conclude from the observations that in the hands of the average gynæcologist radium therapy is recommended.

The new section on "Gynæcological Diagnosis" is good, but we should have liked to read of posterior colpotomy as a diagnostic aid in certain cases.

The operative gynæcology is condensed, as is natural in such a text book, and we were pleased to find that no drainage is used after hysterectomy. However, it is distressing to find the authors describing a good modified Gilliam's operation (similar to Crossen's modification) as a "Gilliam's operation". The original Gilliam operation was dangerous; the modification is good. Ventrofixation is aptly described as "a method which simply replaces one deformity for another".

It is refreshing to see in a text book the Manchester operation for prolapse so accurately described and so

strongly recommended. Also a new operation for excision of the vulva for malignant disease is recommended and appears satisfactory.

Altogether this edition of Eden and Lockyer's "Gynæcology for Students and Practitioners" is one of the best books of its kind that we have seen, and well upholds the high reputation established by its former editions.

DIABETES MELLITUS.

"DIABETES MELLITUS: A CLINICAL STUDY", by T. A. Oliver, Honorary Physician to the Manchester Infirmary and Lecturer in Medicine at the Victoria University of Manchester, is described by the author as an attempt to classify the various types of diabetes which he has met with in the past fifteen years.¹ In his classification he strikes a new note by emphasizing the importance of mobilization of carbohydrate and fat from the "storehouses", that is, the liver and the muscles. This mobilization, he holds, is dependent on the action of the nervous system, the pituitary, the thyroid and the adrenals, acting either independently or in combination. There are four factors concerned with the metabolism of carbohydrates and fats, namely: (i) mobilization, (ii) the storehouse, (iii) ability to store and make usable, and (iv) utilization. He attempts to classify his patients according to the factor or factors at fault, making special inquiry for any stimulus which may be producing an increase of metabolism. Insulin he describes as "the key of the storehouse" which will correct the effects of over-mobilization.

The scheme is suggestive and valuable as an attempt to explain the many types of diabetes which obviously differ very much in their dependence on pancreatic disease. It also explains the importance of sepsis, emotion, or fatigue in initiating or reviving the acute diabetic condition. And incidentally it explains the undoubted good effects of sedatives in some cases in which mobilization may be supposed to have become excessive. This was recognized, but not explained in pre-insulin days when codena and other opiates were used in the treatment of diabetes. The book is well written and well printed and can be recommended.

ANTHROPOMETRY.

DR. GODIN'S work, "Anthropometric Inquiries upon the Growth of the Various Parts of the Body", has now reached a second edition.² The new publication is thoroughly justified, for workers in the field of anthropometry would be hard put to discover a more painstakingly compiled or carefully documented volume. The book as it originally appeared has been supplemented by the addition of a section, over ninety pages in length, concerning the influence of puberty upon bodily growth. The reader is presented with a study, concisely written, upon many growth processes between the ages of thirteen and a half and seventeen and a half years. In Dr. Godin's opinion "the blossoming of the procreative faculty exerts an almost tyrannical influence on body growth and upon that of the mind". Puberty, the learned author considers, stands for nothing unless it be a stage in the development of the germinal lineage; and the outstanding feature of the process of germinal evolution is its unbroken continuity. This so-called "fixity of continuity" was first enunciated by Godin in the year 1911 after lengthy researches; it has now been supported by Professor Vera Dantchakoff, of Columbia University, and by Professor Fauré Frémet, of the Collège de France.

Dr. Godin's book contains details upon the technique of anthropometric measurements and their particular application to the skull, height, limbs and body weight. The indices and bibliographical details are of great excellence and completeness.

¹"Gynæcology for Students and Practitioners", by T. W. Eden, M.D., C.M., F.R.C.P., F.R.C.S., F.C.O.G., and C. Lockyer, M.D., B.S., F.R.C.P., F.R.C.S., F.C.O.G.; Fourth Edition, by H. B. Whitehouse, M.B., M.S., Ch.M., F.R.C.S., F.C.O.G., F.A.C.S.; 1935. London: J. and A. Churchill. Royal 8vo., pp. 964, with 38 coloured plates and 619 illustrations in the text. Price: 38s. net.

²"Diabetes Mellitus: A Clinical Study", by T. H. Oliver, M.A., M.D., F.R.C.P.; 1935. London: John Bale, Sons and Danielsson, Limited. Crown 8vo., pp. 120. Price: 3s. 6d. net.

³"Recherches Anthropométriques sur la Croissance des Diverses Parties du Corps", by P. Godin; Second Edition; 1935. Paris: Amédée Legrand. Royal 8vo., pp. 279.

The Medical Journal of Australia

SATURDAY, NOVEMBER 2, 1935.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction, are invited to seek the advice of the Editor.

FRACTURES.

IN his Jackson Lecture published this week Dr. Neville G. Sutton tells an interesting story, and in the telling he shows how the surgical advances of recent years have thrown greater responsibilities on those who have the care of patients with fractures. How complicated some of the modern procedures may be was shown in the issue of October 19, 1935, by Dr. Thomas King. Between the historical survey of Dr. Sutton and the involved technicalities of Dr. King there is a gap that may in certain measure be filled by general considerations of treatment and of the reason for their adoption. Investigations have been carried out in many different directions. The influence of local excess of calcium and of phosphorus on the healing of fractures has been investigated, vitamin D has been given and diets rich in casein have been used, and so on, but no very helpful findings have resulted. In this regard attention should be drawn to a useful contribution that appeared some time ago from the pen of C. R. Murray.¹

Murray's discussion is confined, as he states, to the phases of the problem which can be of practical

value to the man who has to take charge of fracture patients; he purposely disregards the purely academic side of the subject. For our present purpose this is adequate, but the author is evidently so discriminating an observer that the student of the fracture problem would welcome from him a discussion of all its aspects. Murray has selected observations from the literature which he thinks are sufficiently well substantiated to have a clinical application; he has discussed the evidence and has correlated it with his own views. It will perhaps be best to follow his arguments according to the way in which he has set them out. The first of his observations is that all fractures heal as do wounds elsewhere, unless there is a mechanical, chemical or anatomical bar to healing. Healing takes place through granulation tissue. When the term delayed union or non-union is applied to any fracture in which healing through granulation tissue has occurred, what is really meant is a delay or failure in the process of calcium deposition in the healing connective tissue. The second observation is most important: "Variations in the character and amount of the healing process in bone following fracture are dependent on factors limited to the region involved, quite independent of the subject involved." From this there are two corollaries. The first is that slow union and non-union are not influenced by the age (*per se*) of the patient, by his general state of health, by the presence of chronic general disease such as syphilis or cardio-vascular or renal disease, by general wasting due to other causes, by general metabolic disturbances affecting either the general calcium and phosphorus metabolism, or other phases of metabolism, or by acute infectious disease. In connexion with this observation reference must be made to fractures of certain regions such as the neck of the femur, the junction of the lower and middle thirds of the tibia and so on, in which healing time is slow and delayed union or non-union is common. This, Murray states, is a matter purely of location; he points out that if a patient has a fracture in one of these regions and also a fracture in another region, there is no perversion of healing in the latter region, provided all the other factors are equal. To those who would

¹ Archives of Surgery, September, 1934.

question the truth of the corollary as far as cardiac and renal disease are concerned, it should be pointed out that if slow healing of a fracture occurs, the cause of the slow healing is the state of the circulation and not the cardiac or renal disease. The second corollary to the second observation is that therapy designed to alter the patient's general metabolism or his general state of health, has no appreciable effect on the process of healing. If the first corollary is accepted (and Murray gives many excellent reasons why it should be accepted), the second follows as a matter of course. The third observation put forward by Murray is that the four factors involved in the mechanism of the healing of fractures and capable of being influenced are: (i) the local pathological condition, (ii) the growth of granulation tissue, (iii) an available local source of calcium for the ossification of the healing tissue, (iv) a proper biochemical status of the local tissue fluids throughout the healing process. Murray attaches great importance to the pH value of the local tissue fluids. At first the pH value tends to the acid side; this is dependent on the inter-relationship of tissue necrosis and circulatory efficiency and is associated with decalcification of the dead bone at the site of the fracture. Liberated calcium is held locally and subsequently when the pH value tends to the alkaline side, the locally absorbed calcium is deposited in the newly formed connective tissue to form bone.

This account of Murray's views is admittedly sketchy and inadequate. The article should be studied by all to whom it is available; if it does nothing else it will direct attention to fracture treatment from a somewhat unusual point of view. It will, for example, be clear that the object of treatment should be to restore the circulation of the injured part as far as possible to what would be normal for that part. As Murray points out, the most effective way of doing this is the active use, within pain limits and from the inception of treatment, of the muscular apparatus of the part. It is in this way that much of the success reported by Dr. King in his important contribution has been attained. It is clear also that operative treatment which will remove calcium as well as effused blood

is to be deprecated, and further that repeated and violent attempts to reduce a fracture may increase the amount of necrosis and destroy sources of granulation tissue. In conclusion, it must be emphasized that the healing of fractures is a subject about which much remains to be learned; this is only one branch of surgery in which the experimental worker and the biological chemist may still lead the surgeon to more effective and perhaps simpler methods of treatment.

Current Comment.

THE ADRENAL CORTEX.

THERE has been great speculation as to the functions of the adrenal cortex and whether it elaborates one or more hormones. Of recent years extensive investigations have been made, but much mystery still surrounds it. It is obviously involved in Addison's disease, and virilism in women is seen when cortical tumours exist. Vitamin C (ascorbic or cevitamic acid) has been found in the cortex, but this may represent storage rather than synthesis. The hormone (or hormones) extracted would appear to have no effect on the blood of a normal animal. Extracts are best given parenterally, but a greatly diminished effect follows oral administration. The active principle of the extracts may represent one or more chemical units, even though it is said to have been isolated in crystalline form. In most animals complete ablation and, in man, destruction of the cortex results in death, which is not prevented by administration of medullary adrenaline. In animals extirpation of one adrenal gland and destruction of the medulla of the other have not caused death, and no deleterious effects have been apparent. Extracts of adrenal cortex prolong the lives of dogs and cats that have been deprived of their adrenal glands.

R. F. Loeb, D. A. Atchley and J. Stahl have investigated the rôle of sodium in adrenal insufficiency in man and laboratory dogs.¹ They found that in man, if adrenal insufficiency is not relieved by sodium chloride it will not be benefited by cortical extracts. There would seem to be a definite relation between sodium metabolism and the cortical principles. In cortical insufficiency blood sodium is decreased owing to increased excretion. The diagnostic change in the sodium level becomes more apparent and specific when salt is withdrawn from the diet. Such withdrawal, however, may result in a dangerous crisis. On the other hand, administration of salt often alleviates acute adrenal insufficiency and its continuance mitigates considerably the manifestations of Addison's disease. If the adrenal

¹ *The Journal of the American Medical Association*, June 15, 1935.

glands are completely destroyed, salt alone will not maintain life.

In a further contribution¹ Loeb gives the various opinions as to the functions of the adrenal cortex. These are that it prepotently regulates carbohydrate metabolism or that it regulates the circulating blood volume. Loeb is of opinion that most changes in adrenal insufficiency are due to the loss of sodium with accompanying dehydration. He critically examines the various abnormal manifestations. Decrease in renal function, he states, may depend on an influence of the cortical substance on the kidneys directly, but dehydration and shock aggravate renal insufficiency. Excessive loss of sodium from the body takes place through the kidney and may be termed a disturbance of renal function. Retention of potassium in the blood is a constant finding in cortical inadequacy in animals, and in severe adrenal crises in man. The explanation is unknown. Loeb thinks that perhaps increase in blood potassium or alteration in the sodium-potassium ratio contributes to the collapse in a crisis. Disturbances in carbohydrate metabolism are seen after adrenal ablation. In Addison's disease, hypoglycæmia and insulin sensitivity may be present. But these changes may be due to coincidental medullary deficiency, as insulin sensitivity exists in animals whose adrenal medulla has been destroyed without serious injury to the cortex. In Addison's disease and in animals from which the adrenals are removed the basal metabolic rate is lowered. Loeb considers this to be due to dehydration. He is also of the opinion that the asthenia of adrenal inadequacy in man may be due either to cortical or medullary deficiency; but cortical extract vastly increases the capacity for sustained work in adrenalectomized rats. Loeb again urges that salt loss and dehydration tend to promote shock. This shock may be analogous to histamine shock, in which capillary permeability is increased; possibly the cortical substance exerts a regulating control of the vascular bed. The pigmentation of Addison's disease is not seen in animals with chronic adrenal insufficiency. After treatment with cortical extract, human patients become lighter, which Loeb suggests to be due to rehydration, with stretching of the skin, and not to pigment loss. Pigmentation seems to diminish also with salt ingestion. In man severe neurological disturbances occur; and in untreated adrenalectomized animals spasticity of the hind legs and even convulsions may be seen. These disorders may be associated with hypoglycæmia resulting from deficiency of the adrenal medulla; but neurological disorders may appear in the absence of severe hypoglycæmia and may result from decreased cerebral circulation due to dehydration and shock. No evidence exists that nervous symptoms arise from failure of any normal action of cortical matter on brain cells. The hirsutism and amenorrhœa attending tumours of the adrenal suggest a relationship of such phenomena with basophile adenoma of the pituitary.

¹ The Journal of the American Medical Association, June 15, 1935.

Adrenalectomized animals may be maintained in apparently normal health by cortical extracts, but similar treatment in Addison's disease is not so satisfactory. Cortical extract with sodium chloride is certainly beneficial. In laboratory animals salt alone will prolong life, but not indefinitely. Loeb rightly points out that there is an unfortunate tendency to indiscriminate exhibition of cortical extract in small and infrequent doses to all who are weary and heavy laden. This may be harmless, but is not scientific. Loeb's contributions have done much to clarify the position as to the rôle of the adrenal cortex, but there is still a vast amount of research to be conducted before the mystery is unravelled.

THE DIAGNOSIS OF EPILEPSY.

EPILEPSY is often difficult of diagnosis, especially in young children. Amongst children, as clinicians know, a convulsive seizure may be but the *bravura* accompaniment to any one of many things—encephalitis, rickets, poliomyelitis, cerebral tumour, or the intestinal worm that dieth not. And many are the hysterical women who can foam at the mouth and snort, who can, in short, imitate an epileptic fit so dramatically and exactly as to wring the hearts of all beholders.

The diagnosis of a disease is always fortified and confirmed if the clinical signs and symptoms are corroborated by a reliable laboratory test. Some such consideration may have led A. W. Jacobsen to announce his belief that the retention of water in the tissue spaces will cause epileptic seizures in people who are predisposed to them. Jacobsen stated that such attacks might be produced artificially in such persons by the drinking of large quantities of water and by the hypodermic administration of pitressin, which contains powerful anti-diuretic and pressor principles. This investigator accepted a rise in body weight of from 3% to 6% as evidence that a stage of so-called positive water balance had been reached. By these methods, then, Jacobsen tested some forty odd patients, most of them children. Amongst the known epileptics, fits occurred in all when the state of positive balance was attained. No fits occurred amongst normal persons (that is, controls) given water and pitressin; no fits occurred amongst the epileptics given pitressin alone; no fits occurred amongst the epileptics given water alone.

The reported results of Jacobsen's work appeared last year; much more recently, J. L. Clegg and F. T. Thorpe have busied themselves with the same matter.¹ Choosing sixteen adult epileptics, together with seven non-epileptics as controls, they have carried out Jacobsen's technique, and have prosecuted an inquiry into the osmotic pressure of the blood in its relation to epileptic convulsions. Of the patients selected for the investigation, those taking "Luminal" were permitted to continue its use. In all instances the diet remained unaltered,

¹ The Lancet, June 15, 1935.

and all the subjects were made to stay in bed. The epileptics under scrutiny were chosen deliberately—they were all patients subject to fits only at long intervals. Pitressin was given hypodermically in a first dose of 0.25 cubic centimetre, followed at four-hourly intervals by doses of 0.5 cubic centimetre, the maximum number of injections being ten for any one subject. Water was given to the amount of 300 cubic centimetres every two hours. If convulsions occurred, the patient concerned was fed upon a ketogenic diet (five ounces of cream every four hours for the duration of the period of the seizures) and received neither water nor pitressin.

Of the sixteen epileptics, twelve had one or more seizures during the currency of the test. In two instances hiccup and vomiting became so pitiable that mercy called a halt. The remaining two "negative" cases were those of patients in whom the attacks were normally extremely rare. As to the seven controls, they were unaffected so far as convulsive seizures went by either pitressin or water. And those epileptics who took either water alone or pitressin alone, suffered no ill-effects whatever. Clegg and Thorpe state further that by the use of the Beckmann-Heidenhain cryoscope, they have been able to demonstrate a gradual drop in the osmotic pressure of the blood in proportion to the amounts of water swallowed by the subject. The sum of their conclusions is that the water-pitressin test has a place in the diagnosis of questionable cases of epilepsy, though they admit that barren results may follow its application to those patients in whom the characteristic attacks are separated by long intervals of time.

In fairness it must be said that Byron has not succeeded in discovering any alteration in water balance in the twenty-four hours before a convulsion. His findings indicate that a seizure is followed by a fall in weight, due to the excretion of extracellular body fluids, and that this in turn is succeeded by an increase in weight which has its origins in a retention of water.

Roy T. Fletcher and Olive D. Peden² put forth views that clash with those of Clegg and Thorpe. They have concerned themselves with an investigation of the water content of the blood taken from epileptics during periods of seizure, and have set up these findings against those determined during a quiescent interval. Having estimated the percentage volume of red cells, the serum protein and the whole blood chlorides of 32 patients, both before as well as during the attacks, Fletcher and Peden are left doubting. To them the blood of epileptics, whether during times of quiet or of seizure, has revealed no change of any moment, certainly no change noticeable enough or constant enough to warrant the assumption that there is any connexion, close or remote, between the onset of a fit and an alteration in the metabolism of water.

¹ *The Lancet*, June 15, 1935.

Clearly the matter cannot yet be considered as settled. It may be that pertinent investigations are now under weigh in mental hospitals all over the world, and that the "induced water retention test" may soon afford a sound basis for the diagnosis of epilepsy.

PULMONARY TUBERCULOSIS OF THE LOWER LOBE OF THE LUNG.

MANY times it has been pointed out how slowly the teachings of the pathologist are brought to apply to the patient at the bedside. The reason for this is the difficulty of recognizing during life the anatomical lesions as seen at autopsy. It is well recognized that the most characteristic lesions of chronic pulmonary tuberculosis are found in the upper lobes, and more usually towards the apices. The subapex rather than the true apex is now known to be the site of election for the early manifestations of the disease, but it is generally supposed that affection of the lower lobes is rare. In fact many medical writers have aphoristically stated that when physical signs suggesting an inflammatory process are discovered in the lower lobes it is improbable that these are due to tuberculosis except as part of an extensively advancing process. The morbid anatomist has, however, for many years laid stress upon the upper part of the lower lobe as one of the commoner locations for tuberculosis. That primary lower lobe tuberculosis is not common is generally agreed; that it is extremely rare is probably not true. C. E. Hamilton and H. Fredd, in writing on this topic, have recently recognized 3% of the cases of pulmonary tuberculosis as occurring in the lower lobes.¹ Their patients were admitted by ordinary routine to the tuberculosis wards of a general hospital and, they think, represent an unduly low percentage, other cases being probably unrecognized. It is interesting that females predominated, a point also insisted upon by D. Reisner in an elaborate study of the same subject.² The latter writer considers that the difference in the types of breathing observed in the two sexes may account for this. Certainly it must be admitted that the actual base of the lungs is very rarely affected. In fact, as all these writers remark, there has probably been some clinical confusion as to the extent of the lower lobes affected by disease, for by ordinary means of examination and by an antero-posterior X ray film this is not always clear. Moreover when the apex of the lower lobe is affected by tuberculosis the disease appears towards the hilum in a position that really needs a lateral skiagram to make its boundaries plain. It is lesions of this kind that have given rise to the so-called "hilar" tuberculosis, a misnomer due to faulty anatomical description.

Hamilton and Fredd and also Reisner point out that the radiologist hesitates to express the opinion that lower lobe disease is tuberculous on account of

¹ *The Journal of the American Medical Association*, August 10, 1935.

² *Archives of Internal Medicine*, August, 1935.

its location until a definitely cavitated type of lesion declares itself. Chronic bronchitis, bronchiectasis, neoplasm and unresolved pneumonia may be difficult to distinguish and, what makes the diagnosis still more obscure, the sputum may not contain demonstrable tubercle bacilli, even on repeated examination. Hamilton and Fredd state that the lower lobe lesions are less "open" than those of the upper lobes and that the various "tricks" by which freer specimens of sputa are obtained are often required in order to establish a positive diagnosis. They consider, however, that the clinical course resembles that of the upper lobe primary disease, and thus the history is a most reliable and important aid in arriving at a conclusion. Reisner remarks on the tendency to cavity formation in the lower lobe, and finds that when cavities have formed they do not tend to drain well on account of their location. For this reason X ray films may demonstrate a fluid level, yet the sputum may less readily reveal the nature of the infection. He has observed a rapid onset in a large proportion of these cases, the initial pneumonic type of lesion soon ulcerating and forming cavities, and spread through the lung taking place with relative facility. These considerations form a strong argument for artificial pneumothorax treatment. Hamilton and Fredd have not observed that the prognosis is any worse than with tuberculous disease of the upper lobes, but they have employed collapse therapy in most of their cases. Reisner appears to be of similar opinion, though, as above pointed out, he emphasizes the ease with which spread occurs unless prevented by efficient relaxation therapy of the affected lung. As regards physical signs little difficulty exists when the lower lobe is extensively involved. In early cases, however, Reisner stresses the paucity of the demonstrable signs; even though the site of the lesions is not very deep, since it is often dorsally placed and approximates to the paravertebral zone between the fifth and seventh dorsal vertebrae, signs are apt to be misleading. In conclusion, it should not be forgotten that tuberculosis of the lower lobes occurs, especially in women; tuberculosis in this situation requires a thorough physical, radiological and bacteriological investigation and, being prone to early cavitation and progressive spread, demands energetic treatment.

ASTHMA.

An important symposium on asthma comes in a reprint of several articles that have appeared in *The Medical Press and Circular*.¹ The articles in the symposium are preceded by an editorial contribution. The fundamental statement is made that all the subdivisions of asthma may with advantage be eliminated and the fact accepted that there is only one asthma. It is held that

division and subdivision only complicate the position and tend to obscure the basic facts on which the condition is actually built. The three basic factors emphasized in this symposium are a toxicosis, a nasal factor and an autonomic imbalance. The views of the several authors regarding these factors are of interest.

James Adam, of Glasgow, points out that the influence of heredity in asthma is undoubted; it is an important factor, and in some instances the most important factor. He holds, however, that it is generally less important than the nutritional or environmental factor; this is proved by the results of treatment of the environmental factor in many cases of asthma in adults and in almost all asthma in children. Since allergy is demonstrable in only about 50% of cases, Adam regards it as reasonable to suppose that there is behind allergic and non-allergic asthma a "toxic soil on which allergy is prone to grow".

Alvin W. La Forge, of the International Clinic at Tunbridge Wells, stoutly upholds the toxicosis origin of asthma. He states that though bronchospasm is universally accepted as the essential diagnostic *sine qua non* of asthma, clinicians have long recognized that in addition to bronchospasm one or more other conditions are invariably associated with it. These conditions include urticaria, angioneurotic oedema, eosinophilia, eczema, sensitization to foods, protein and non-protein substances, animal emanations, dusts, *et cetera*. The workers issuing this symposium regard these associated symptoms as being biochemical manifestations of asthma (as essentially expressive of it as bronchospasm) due to a perversion of metabolism designated by them toxicosis. The stand taken by them is that they do not deny the sensitized state, but they view it as a condition imposed on an already existing factor, toxicosis; they do not regard it as necessary to isolate some toxic substance or substances, since they believe that excess of normal body constituents is enough to produce the condition.

Because allergy is not demonstrable, it cannot be concluded that it does not exist; and even if a basal toxicosis is admitted it may still be argued that all asthma is allergic. Bray, well known for his work on asthma, has pointed out that Adam does not explain why all persons with nasal disease or intestinal toxæmia do not suffer from asthma, for nasal disease and intestinal toxæmia are extremely prevalent and asthma is comparatively rare. Bray holds—and it is difficult to see how he can be gain-said—that the patient must be allergic, that is to say, he must have inherited or acquired the predisposition to manifest a response. Although Adam and his fellow workers do not convince us that their views are correct, their work should be studied by those who are interested in the subject. It has not been possible in this short statement to do more than refer to their basic belief. As more attention is centred on discovery of the true nature of asthma, less attention will be paid to purely symptomatic treatment—each patient will be submitted to searching investigation for the cause of his illness.

¹"Asthma: A Symposium", by J. Adam, M.A., M.D., F.R.F.P.S.G., B. Haseltine, M.D., F.A.C.S., A. W. La Forge, M.D., LL.B., K. Phillips, M.S., M.D., A. J. D. Cameron, M.B., Ch.B., A. Sercer, and M. Kern, M.D.; reprinted from *The Medical Press and Circular*, May 15, 1935. Price: 2s. 6d. net.

Abstracts from Current Medical Literature.

MEDICINE.

Cholesterin.

M. H. PAILLARD (*La Presse Médicale*, March 23, 1935) discusses corneal *arcus senilis* and the relationship between cholesterol deposit in the cornea and elsewhere in the body. Four hundred and twenty patients were investigated in whom the *arcus senilis* was obvious; 7% of these patients presented xanthoma, 2.5% gouty tophi, 13.5% dry polyarthritis, 26% had cellulitis, 2% showed signs of arterial atheroma and 11% gallstones. The *arcus senilis* was due to cholesterol deposit; it was associated with increased amounts of cholesterol in the body and with cholesterol deposits elsewhere as indicated above; but the blood cholesterol content had not been shown to be above normal. It is suggested that the *arcus senilis* may indicate a tendency to cholesterol deposit elsewhere in the body, especially in the biliary apparatus.

Industrial Solvents.

L. DAUTREBANDE (*La Presse Médicale*, July 6, 1935) discusses the paralysis of the vasomotor system by volatile industrial solvents. Benzol, *l'éther de pétrole* and amyl acetate have been widely used in recent years as solvents and as vehicles for applying powdered preparations with a "gun". The inhalation of each of these substances causes a fall of blood pressure in laboratory animals, especially when the temperature is above 28° to 30° C. Amyl acetate is present in a varnish called cellulose, which gives rise to vasomotor paralysis, resulting in a fall in blood pressure. Benzol is known to cause convulsions by its action on the central nervous system, but its vasomotor effect is apparently through the splanchnic nerves. It has been shown that benzol, *l'éther de pétrole*, amyl acetate and cellulose varnish all cause a fall of blood pressure in antagonism to such vaso-constrictors as lobeline, bordenine and adrenaline; hence the action of these vaso-dilators may be on the vessel wall itself. They can give rise to tachycardia, quickly followed by bradycardia; the injection of adrenaline in such an animal gives rise to syncope associated with ventricular fibrillation. In view of their toxicity and widespread use in industry these substances should be the subject of further investigation and subsequent regulation.

Rheumatoid Arthritis.

S. J. HARTFALL AND H. G. GARLAND (*The Lancet*, July 6, 1935) report the results of treatment of chronic and rheumatoid arthritis by the intravenous or intramuscular injection of

gold salts. Acute, subacute and chronic conditions were treated. Among 100 patients good results were claimed in 70 to 90. Gold sodium thiosulphate was injected in doses of 0.05, 0.1, 0.2 gramme, and thereafter 0.2 gramme at weekly intervals until not more than 2.0 grammes had been given; at least six weeks' rest was then allowed, when another course of injections was given, if necessary, up to three or four such courses being administered in some cases. Painful exacerbations in the joints occurred in 45 patients, usually after one of the first doses; these patients as a rule did well eventually. Other toxic reactions were generalized pruritus in 36 patients, erythema in 28, desquamation in 4; diarrhoea and colic, soreness of the mouth or ulceration, vomiting, albuminuria, hyperkeratosis of soles and other skin manifestations occurred, always within a week of the last injection. Three patients died, one with agranulocytosis three months after treatment, one with purpura, hæmatemesis and anaemia during treatment; the third fatality was in a woman of sixty-three years, who developed an erythema during treatment, and seven weeks after the last injection hæmaturia and hæmatemesis occurred with other evidence of purpura. As much as 13.9 grammes has been injected in some patients. In view of the dangers and variations in susceptibility, great caution is necessary in treatment.

Insulin Requirements of Diabetic Out-Patients.

R. M. MURRAY LYON (*Edinburgh Medical Journal*, May, 1935) has made an examination of a series of 600 case histories of patients attending the diabetic follow-up department in the Royal Infirmary, Edinburgh. The cases were quite unselected, and all the patients had been under observation for at least one year. All cases are grouped as follows: Type I, acute or toxic; Type II, obese; Type III, arteriosclerotic. At some time 55% of all patients required insulin, 17% of these being able to discontinue its use. The insulin requirements vary according to the particular type concerned; thus 66% of Type I required insulin at some stage, while only 10% were able to discontinue its use; 33% of Type II were put on insulin, and 22% of them required it permanently; of Type III, 56% needed insulin treatment, and 44% of these were subsequently treated without it. An analysis of the actual reasons which demanded the institution of insulin therapy was made and is recorded in table form. There are three classes of conditions which have led to the use of insulin: general severity of the disease, as shown by loss of weight, weakness and inability to get rid of glycosuria by simple dietary measures; secondly, coma and ketonuria; thirdly, complications of the disease, sepsis, gangrene and anaesthesia. In this series there were 25 patients under the age of twenty

years; they all required insulin and it had to be given permanently. Considering the dosage of insulin given, the variation in the individual doses was naturally considerable, but the average was relatively low. When those who required insulin permanently are considered, the approximate daily doses were found to be 25 units in Type I, 20 units in Type II, and 22 units in Type III. In some cases it was necessary to restabilize the dosage permanently at a higher level, and the new average figures then were 30, 27 and 26 units respectively. It would appear then that, although insulin is more likely to be required in the acute toxic cases, the obese and arteriosclerotic types of patient, if they do require the drug, need almost as much as Type I patients. Sepsis is the most important single factor in determining a permanent higher insulin dosage, and this applies to all groups. Hypoglycemic attacks of varying degrees of severity occurred in about half the insulin cases, and they took place on very low doses of the drug, only slightly higher than those on which the patients were free.

Plasma Cholesterol in Tuberculosis and Amyloid Disease.

Studies of blood cholesterol have demonstrated a low level in acute febrile disorders and the acute stages of syphilis, leprosy and tuberculosis. In long-standing tuberculosis, however, the level is not constant, variations being dependent on the severity of the lesion, the body nutrition and anaemia. S. Edward King and Maurice Bruger (*Annals of Internal Medicine*, May, 1935) have studied the plasma cholesterol in tuberculosis, with particular reference to complicating amyloid disease of the kidney. A rise in blood fats and cholesterol is characteristic of the oedematous forms of Bright's disease known as "lipoid nephrosis" and the nephrotic type of glomerular nephritis. The increased blood cholesterol in amyloid disease of the kidney with oedema is presumably identical with that of the oedematous forms of nephritis. It is noteworthy that hypercholesterolaemia preceded the appearance of oedema in cases of amyloid disease with marked proteinuria. A high blood cholesterol is unusual in tuberculosis without amyloid disease. In the absence of proteinuria a normal or slightly elevated cholesterol level persistently maintained is a favourable prognostic sign; conversely, a low or falling cholesterol level in tuberculosis is a reliable indication of an early fatal termination. In tuberculosis complicated by amyloid, the proteinuria is the important factor depleting plasma proteins and resulting in lipemia. Thus early amyloid without renal involvement (absent proteinuria) has no appreciable effect upon the blood cholesterol in tuberculosis. The blood cholesterol rises before oedema develops in cases of amyloid of the kidneys with marked proteinuria. The elevated plasma

cholesterol does not increase the resistance to the tuberculous process; seven patients with blood cholesterol levels of 200 milligrammes or less died within two months. When the nephrosis syndrome is present, a normal cholesterol level is an indication of a diminishing cholesterol curve and has the same significance as actual hypcholesterolemia. The cachexia incident to marked impairment of kidney function or to advanced tuberculous disease has the same depressing effect upon the level of the blood cholesterol.

The Mode of Action of Artificial Pneumothorax.

A. AND L. DE CARVALHO (*Revue de la Tuberculose*, May, 1935) discuss the reasons for the good results which follow artificial pneumothorax therapy. The belief is no longer held that it is a matter of simple compression of the diseased lung, as rapid improvement so often follows the early insufflations before complete collapse has been attained. It is generally admitted that healing of the tuberculous lesion is aided by fibrosis, and that pneumothorax assists in freeing the lung and allowing retraction and fibrosis to take place. But the authors maintain that fibrosis does not simply result from the lung being at rest. Taking as a parallel other organs of the body, they postulate a circulatory disturbance as the cause of the pulmonary fibrosis. This could be, by analogy, either a hyperemia or an ischemia. By the method of angiopneumography, that is to say, by the injection of a fluid opaque to X rays into the pulmonary circulation, they have satisfied themselves that the basic factor is an ischemia. With even a slight pulmonary compression there is almost complete suppression of the pulmonary circulation in the affected lung, the opposite lung showing at the same time a compensatory hyperemia. Thus it is that symptoms of tuberculous toxemia, such as fever, night sweats, anorexia and the like, disappear so rapidly; the toxins can no longer be absorbed and disseminated in the general circulation. Their study leads the authors to conclude that the beneficial action of artificial pneumothorax is due in greater part at least to the resultant ischemia of the affected lung.

Circumscribed Myxedema.

THE reports of cases of circumscribed myxedema indicate that there are two distinct types: nodular, with lesions involving the face, arms, back and scrotum; and, secondly, those with myxedematous plaques limited to the pretibial areas of skin. This latter group is invariably associated with hyperthyroidism. The only consistent point of similarity between the two groups is the histological picture of a biopsy of the affected skin area. The cases described by E. W. Netherton and B. E. Mulvey (*The Journal of the American Medical Association*, April 27, 1935) fall into the second group.

The cutaneous lesions are symmetrical, irregular, raised, slightly erythematous or brownish-yellow oedematous plaques involving the skin in the pretibial areas. In most instances dimpling of the follicles gives the surface of the lesion an appearance resembling pig skin. The myxoedematous changes in the skin usually develop after the manifestations of the initial or recurrent hyperthyroidism have become apparent, but in one other reported case the cutaneous lesions appeared first. Lesions may develop during the active manifestations of thyroid intoxication or at varying periods after the patient has been relieved by thyroidectomy. Following the operation, signs of hypothyroidism or mild generalized myxedema of a more or less transitory nature may precede or accompany the appearance of the plaques in the legs. The administration of thyroid extract causes in most instances an improvement or complete disappearance of these symptoms without producing any change in the localized lesions. The skin and hair may be dry and the nails become brittle. However, the hands and feet are not swollen, and the oedema about the eyes and face, and the subcutaneous oedema or the cushion-like accumulation of fat in the supraclavicular regions, which develop in a marked case of generalized myxedema, do not form a part of the clinical picture of the circumscribed type. The patient may or may not complain of itching and burning of the involved skin. The histological changes are limited to the corium; they are described in detail. The aetiology of the condition is unknown. Differential diagnosis of the plaque includes scleroderma and lymphoedema; a biopsy may be necessary. Treatment is unsatisfactory; spontaneous recovery has been observed, but simultaneous thyroid and iodine medication seems the most successful therapy thus far.

Modern Diabetes Problems.

C. BRENTANO (*Deutsche Medizinische Wochenschrift*, March 8 and 15, 1935) discusses modern diabetes problems. The whole symptom complex of diabetes results from an absolute or relative insulin deficiency. The blood sugar derived from the diet must be converted into glycogen before it can be stored in the liver or used by the tissues. Diastase effects this conversion under the influence of insulin. But the action is reversible. If the influence of adrenaline preponderates, instead of glycogen synthesis there occurs a splitting of glycogen into glucose. Thus a result of insulin deficiency is that both liver and muscles contain less glycogen than normally. Despite hyperglycemia, the tissue cell is poor in glycogen. Production of glycogen occurs more readily the greater the excess of glucose over glycogen. With the blood sugar at 0.04% no glycogen is formed, and hypoglycemia results. Normally the optimum blood sugar level for

glycogen formation is about 0.09%, but with insulin deficiency a higher blood sugar level is needed. And the less the available insulin, the higher must be the blood sugar. In the depancreatized dog 0.4% is about the level at which glycogen formation is again possible. The symptom complex hypoglycemia does not depend on the absolute height of the blood sugar, but on the breakdown of the glycogen supply to the cells; and this breakdown is produced by deficiency as well as by excess of insulin. The clinical picture of diabetic coma often bears a striking resemblance to that of hypoglycemic shock. In both there is a "sugar block" which prevents glycogen formation, in the one through lack of sugar (insulin shock) and in the other through lack of insulin (diabetic coma). Rational treatment of diabetes depends on two principles: (i) give sufficient carbohydrate in the diet, and (ii) enable the diabetic to make use of this carbohydrate. The low carbohydrate diet obviously does not fulfil these principles. On this diet the blood sugar usually falls and the glycosuria ceases, not through improvement of metabolism, but because of failure of the principal source of carbohydrate, the diet. The object of diabetic treatment should be to effect the metabolism of a maximum of carbohydrate. The carbohydrate balance, that is, the excess of carbohydrate intake over urinary sugar, should be as high as possible. Provided that the intake be sufficient to maintain a good balance, the loss in the urine is of minor consequence, within certain limits. A diabetic ingesting 160 grammes and losing 20 grammes in the urine (a balance of 140 grammes) is better off than if ingesting 80 grammes with no glycosuria (balance 80 grammes). Hyperglycemia is not necessarily harmful and may be a useful compensatory condition. It must not be lowered at the expense of the carbohydrate balance. A good balance with a blood sugar of 0.25% indicates that carbohydrate metabolism, that is, formation of glycogen, is adjusted to this blood sugar level. The idea that hyperglycemia favours infection is wrong. It is glycogen poverty of the cells, not hyperglycemia, that favours infection. The absolute amount of sugar lost in the urine does not indicate the severity of the condition. For example, of two patients, each excreting 20 grammes of sugar, one is ingesting only 40 grammes of carbohydrate and the other 150 grammes. Here the condition of the former is severe and that of the latter slight. Glucose tolerance, that is, the amount of carbohydrate which a patient can ingest before he shows glycosuria, used to be taken as a guide in treatment, and the carbohydrate intake used to be reduced to one-half or at most two-thirds of the tolerated amount. But experiment has shown that increase of the carbohydrate intake above the ascertained tolerance level is not followed by a corresponding increase of glycosuria. A

patient with a tolerance of 60 grammes was given gradually increased amounts until he was taking 160 grammes; but now he was excreting only 20 grammes, thus retaining and utilizing 80 grammes of the increase. An increase to 260 grammes added 30 grammes to the amount excreted. With further increase of carbohydrate intake the balance became gradually less favourable, until with an intake of 320 grammes none of the last increase was retained, but all excreted, this being the point beyond which the carbohydrate assimilation of this patient could not be raised. Further increase was followed by metabolic deterioration, and not only were the additional amounts of carbohydrate lost, but an increasing proportion of the carbohydrate which previously he had been able to assimilate. Subsequently, on a diet of 160 to 200 grammes of carbohydrate he excretes only 20 to 30 grammes of sugar, leaving him with an excellent balance. His blood sugar is 0.14% to 0.18%. Conversion of a maximum of carbohydrate is much assisted by insulin. Excepting in the slighter cases, every diabetic should get enough insulin to keep the urine sugar-free on a high carbohydrate diet freely chosen by himself. After 10 to 14 days of this carbohydrate cramming the insulin and carbohydrate are gradually reduced for about two weeks, but as a rule the latter not below 120 to 150 grammes. In a majority of even severe cases the glycosuria does not return after insulin is suspended, or at most only a few grammes. The improved metabolism persists for many months, perhaps longer. Then the "balance" falls and the insulin cure must be repeated, perhaps two or three times in a year. It is still true that the diabetic who is not on insulin should be kept on a low calorie diet, but this idea must not be pushed too far. A patient who is still working should get 35 to 40 calories per kilogram of body weight, and more if the work be laborious.

Water Intoxication.

F. C. HELWIG, C. B. SCHUTZ AND D. E. CURRY (*The Journal of the American Medical Association*, May 4, 1935) report a fatal case of water intoxication and describe experiments in which rabbits were subjected to large rectal injections of tap water. A woman, aged fifty years, after operation on the gall-bladder, was given rectal injections of tap water until 9,000 cubic centimetres had been given in thirty hours. The patient died after stupor and convulsions had occurred. *Post mortem* the outstanding change was oedema of the brain. Following this, six rabbits were given 50 cubic centimetres of tap water *per rectum* every half hour after withholding all food and fluids for two days. During the first three to four hours urinary output increased; after this time the urine decreased and convulsions occurred intermittently at first, then continuously, until death occurred.

The blood chlorides decreased, ranging from 100 to 240 points. *Post mortem*, cerebral oedema with vacuolization in the ependyma, stroma and the choroid plexus were marked, and cloudy swelling of the liver was noted. Chlorides were decreased 50% below the normal in the brain, and to a less extent in all the tissues of the body except the liver, in which a rise in chlorine content was observed. The authors emphasize the possibility of producing water intoxication by the injudicious forcing of fluids.

Hepatoptosis.

In reporting a case of hepatoptosis and gunima of the liver, Charles W. McClure *et alii* (*American Journal of Digestive Diseases and Nutrition*, May, 1935) give their results of an exhaustive study of the former condition in seventy cases, proved by laparotomy and autopsy. It is almost entirely confined to women, and loss of tone of the abdominal muscles and trauma to the abdominal contents are described as the important aetiological factors. Fifty-three cases of this group presented hepatoptosis as the sole organic lesion found, and the symptoms as described by the patients have been classified as follows: (i) hepatic—pain, jaundice, chills, fever; (ii) gastro-intestinal—anorexia, nausea, vomiting, hæmatemesis, diarrhoea, constipation, melena; (iii) cardio-respiratory—dyspnoea, cough, oedema, tachycardia; (iv) genito-urinary—frequency of micturition, dysuria, hæmaturia; (v) general—headache, malaise, nervous irritability, dizziness, insomnia; (vi) latent—no subjective symptoms; (vii) accessory—sensation of tumour on bending or exertion. Both abdominal pain and jaundice occurred in sufficient numbers of uncomplicated cases to establish them as symptoms and signs resulting from the displacement of the liver. A complete explanation of all symptoms is not possible; thorough investigation of the respiratory and cardiac systems was not carried out, so symptoms referred to these systems may possibly have been due to local disease; the fact that hepatopexy exerted a very favourable influence suggests, however, that they are due to the displacement of the liver. The usual findings may be summarized as a freely movable, non-tender tumour, occupying the right side of the abdomen, the lower border perhaps being below the iliac crest, and the upper border may be below the costal margin. The mobility of the tumour enables the surgeon to perform hepatopexy, and this procedure was found to be very successful in relieving the symptoms.

Acute Cor Pulmonale.

SYLVESTER MCGINN AND PAUL D. WHITE (*The Journal of the American Medical Association*, April 27, 1935) and PAUL D. WHITE (*Annals of Internal Medicine*, August, 1935) have described a condition in which dilatation of the pulmonary artery and of

the right heart chambers results from a sudden great obstruction to the pulmonary circulation, best exemplified by massive pulmonary embolism. They have suggested the term "*acute cor pulmonale*" to designate this condition, which is represented by some twenty cases in their experience. The chief features are: sudden onset of substernal pressure with dyspnoea and sense of suffocation, accompanied by vasomotor shock, ashy pallor, thready pulse, low blood pressure and cold sweat; there follows in a few hours a rise in temperature, pulse and respiratory rates, also an increase in the total white cell count. A vascular accident in the coronary circulation usually gives rise to similar symptoms and signs. If the embolism is sufficiently massive to cause dilatation of the right side of the heart, certain early signs of such a phenomenon may appear: cyanosis; dilatation and increased pulsation of jugular veins; increased prominence and pulsation, noted by inspection and palpation, in the region of the second and third intercostal spaces, just to the left of the sternum and overlying the dilated and sometimes overactive pulmonary artery and conus of the right ventricle; gallop rhythm; friction rub in the same area; accentuated pulmonary second sound and loud pulmonary systolic murmur. The cardio-vascular signs may subside quickly or may last for days until death or recovery takes place. Lung signs become apparent after the first twelve to twenty-four hours: cough, bloody sputum, friction rub, and signs of consolidation. There is as yet no radiographic evidence of any value, but the electrocardiographic studies have been carefully carried out and may yield useful information. Lead IV particularly needing further investigation. Differential diagnosis must include coronary thrombosis, dissecting aortic aneurysm, spontaneous pneumothorax and pulmonary oedema from heart disease with or without cardiac asthma. Two important diagnostic features of the *cor pulmonale* are, first, the presence of a possible site for the formation of the embolism, secondly, recurrence at short intervals. Digitalis in full doses and venesection are useful in selected cases. Pulmonary embolectomy is a procedure which may be attempted when the condition is severe.

Ketogenetic Diet in Epilepsy.

LOUIS FISCHER (*Archives of Pediatrics*, February, 1935) emphasizes the value of the ketogenetic diets in the treatment of epilepsy. He refers to fasting as the most effective therapeutic procedure in the majority of children with severe epilepsy; there is a cessation of seizures, and the patient's mental processes appear to be most nearly normal under this condition. The nearest diet to approach the fasting state is the ketogenetic diet. He quotes Lennox and Cobb as saying that there was no constant anatomical lesion in epilepsy and only a minority of patients with extensive cerebral

lesions had fits; that they were forced to postulate some unknown constitutional element; and that almost any lesion, plus the unknown X, which they called functional instability, might result in epilepsy. According to Irvine McQuarrie, as the result of experimental studies on epileptic children, the chronic convulsive tendency is due to some abnormality inherent in the brain cells, which is not detectable by our present histological technique. "Although other methods of approach to this phase of the problem have been comparatively fruitless so far, that of determining the nature of alterations in the chemical constitution of the body fluids, following the use of regimens or procedures known to induce or to prevent seizures, appears to be most promising." The author gives a detailed case report of a child, aged six years, whose spasms could not be controlled by the use of drugs. After six months of antispasmodic treatment a ketogenic diet was given. The result was gauged by the constant supervision of the urine. When acetoneuria was present the spasms either ceased or were negligible compared with the previous results. Specific results were noted after the persistent use of the ketogenic diet. Months passed before another attack occurred.

Barbiturate Poisoning.

G. CARRIÈRE AND C. HUBIÈZ (*La Presse Médicale*, March 23, 1935) discuss eleven cases of barbiturate coma. In eight cases "Gardenal", 1.5 to 3.0 grammes, was the cause; "Dial", 1.75 grammes, and veronal, 5.0 grammes, had been taken with suicidal intent in two other cases. Symptoms included convulsions, fever, leucocytosis, cyanosis, congestion of the lung bases, oedema of the lungs, asphyxia and circulatory collapse. *Post mortem* examination in three instances revealed congestion of the brain, chromatolysis, renal and hepatic congestion, suprarenal degeneration and hyperæmia. In treatment strychnine was injected in doses of one centigramme every hour, up to 30 centigrammes, three cubic centimetres of "Coramine" hourly up to 50 cubic centimetres, and 20 cubic centimetres of 30% hourly up to 150 cubic centimetres. Each of these drugs was of value if used early. In the three patients who died treatment was undertaken 10 to 15 hours after the ingestion of the drug, with poor response.

Fever Therapy.

P. S. HEUCH, C. H. SLOCUMB AND W. C. POPP (*The Journal of the American Medical Association*, May 18, 1935) discuss fever therapy in the treatment of chronic arthritis. Treatment which aims at raising the body temperature to 39.4° to 40.5° C. (103° to 105° F.) has been widely approved for chronic joint affections. Intravenous *Bacillus coli* or *Bacillus*

typhosus vaccine, hot water baths, diathermy and other methods have all given relief in a proportion of cases. The authors used a hot air cabinet, the Kettering hypertherm, in which the patient was enclosed, the head being exposed to the air. In this cabinet the body temperature was raised, by means of hot air, to 40.5° to 41.6° C. (105° to 107° F.) and maintained at that temperature for four to six hours. Remarkable improvement occurred in gonorrhœal arthritis; but in other forms of arthritis, atrophic and hypertrophic, the results were less satisfactory, though improvement was recorded in more than 20% of cases. Salt solution, 0.6%, was given by mouth to the amount of two to four litres during the treatments in order to replace the chlorides lost by sweating. As a rule eight treatments were given.

Mild Hypothyroidism.

BLANTON P. SEWARD (*Annals of Internal Medicine*, August, 1935) has analysed fifty-three histories of patients suffering from mild or moderate hypothyroidism and notes that the vagueness of the symptoms is in contrast to the definite symptoms of myxœdema, but similar to functional disorders and organic disease of other systems of the body. Most of these cases fall into the 30 to 49 years age group; a constitutional factor seems to play more part in the aetiology than infection. The most important constant symptom is ease of fatigue on mental or physical exertion; other symptoms are mental depression or irritability, insomnia, headache, palpitation, vague gastro-intestinal disturbances, change in weight, and vague joint and muscular pains. The average duration of symptoms is two and a half years. A thick, smooth and papery skin is the only manifestation of myxœdema found in the entire group. Low basal metabolic rate is a constant finding, for on this fact the diagnosis ultimately rests. A mild anaemia is found in some cases. Such conditions as hypopituitarism, hypovarianism, hyposuprarenalism, starvation, neurasthenia, neuro-circulatory asthenia and tuberculosis must be excluded before making the diagnosis. Treatment consists of the administration of thyroid extract by mouth and the maintenance of a cheery optimism.

The Influence of Cold on the Rate of Epinephrine Secretion from the Suprarenal Glands.

M. WADA, M. SEO AND K. ABE (*Tohoku Journal of Experimental Medicine*, June 30, 1935) record investigations of the effect of cold stimulus applied by two different methods upon the rate of the epinephrine secretion from the suprarenal glands, with simultaneous observations on the glycaemic level and the body temperature in the non-anæsthetized, non-starved dogs. The posterior spinal roots corresponding to the operation area for exposure of the suprarenal vein were sectioned under asepsis

several weeks previous to the cooling experiment, so that the procedure for exposing the suprarenal vein through the lumbar route and collecting blood samples therefrom was not attended by any sign of pain, and no anaesthesia was necessary. Epinephrine in the suprarenal vein blood was determined by means of the rabbit intestine segment method and the paradoxical eye reaction of the cat. The blood sugar was determined by the Hagedorn and Jensen method, blood samples being taken from a femoral artery, uncovered under local anaesthesia with 0.5% "Novocain" solution. Two methods of cold stimulus were used. In the first method amounts of cold water at 0.5° C., varying from 1,000 to 1,600 cubic centimetres, were introduced through a gastric fistula which had been previously prepared. Such cold stimuli resulted in no alteration, or a very slight increase in secretion of epinephrine during the development of most vigorous and continued shivering. The blood sugar level showed only a very slight increase. The body temperature fell gradually, its lowest level being reached in half an hour, the actual fall ranging between 0.5° and 1.5° C. The second method of cooling used was immersion of the animals in cold water up to the neck for a period varying from about twenty to forty minutes, until their body temperatures fell to below 30° C. In these animals the rate of the epinephrine output underwent a definite and conspicuous increase lasting for an hour or more. The greatest increase in the rate was indicated in the blood taken after cessation of the cold bath. (No samples were taken when the animals were in the bath.) The greatest amount of epinephrine given off from both glands per minute ranged between 0.0003 to 0.0004 milligramme per kilogram body weight. Usually the extra secretion of epinephrine diminished along with the recovery of the body temperature. The blood sugar level showed a considerable increase after exposure to cold in the majority of cases. The fall of body temperature was from 9° to 16° C., the temperature being taken soon after the animals were taken out of the cold bath.

Granuloma Inguinale.

T. BHASKARA MENON AND P. NATESAN (*The Indian Medical Gazette*, February, 1935) discuss the venereal origin of *granuloma inguinale*. They assert that a careful inquiry very often reveals a history of a primary lesion, in the form of a small pustule, which bursts, leaving a small non-indurated ulcer. They also describe a second stage, with the commencement of a granulating lesion and secondary nodules, and a third stage of chronic *granuloma genito-inguinale*. They believe that there is a venereal history in the majority of cases; in others there are extragenital lesions, which can be explained similarly to extragenital chancres in syphilis.

British Medical Association News.

SCIENTIFIC.

A MEETING OF THE NEW SOUTH WALES BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the Robert H. Todd Assembly Hall, British Medical Association House, 135, Macquarie Street, Sydney, on July 25, 1935, Dr. A. M. DAVIDSON, the President, in the chair.

Acute Bone Infections Involving Joints.

DR. KEITH SMITH read a paper entitled: "Acute Bone Infections Involving Joints" (see page 620).

DR. JOHN HOETS said that Dr. Smith had dealt with the very important anatomical points in connexion with the several most commonly affected joints in a manner which left nothing to be said on the subject.

A joint near an infection in bone would often become the seat of a pathological condition which might, but usually did not, go on to pus formation. The signs present would be a general enlargement of the joint with oedema of all the soft tissue entering into its formation as well as excess of fluid within the synovial sac. There was pain, limitation of movement and generally a moderate rise of temperature. There followed a period of anxious watching before it was evident that the condition was settling down or the joint became so full that a needle was introduced and the fluid examined. During this period of watching the most helpful measure was absolute rest to the limb, which could be secured best by application of a plaster cast. To this subject of rest he would return later. When the course was favourable this condition subsided, but the swelling was apt to be followed by a joint greatly restricted in movement owing to the oedema of soft tissues, with subsequent loss of flexibility. Why did these changes occur? Dr. Hoets thought that they were primarily mechanical, particularly when the joint was distal to the bone infection. For example, in osteomyelitis of the lower one-third of the femur the inflammatory swelling about the infected bone caused pressure and obstruction to normal lymph flow, with consequent tissue oedema and increase in synovial fluid. This might be followed by infection of the joint, in which case presumably the infecting organism travelled against the normal directional flow to gain access to the synovial cavity. When infection of the joint cavity did take place, determination of the infecting organism by culture after aspiration was in some measure helpful to prognosis. Apart from the joints infected by direct extension, if such indeed was the method of infection and not through the blood stream, the pneumococcal joints were generally considered to have the best chance of recovery with some degree of useful function.

Dr. Hoets had under his care a young man with chronic osteomyelitis of both femora. Every few months he presented himself with a painful swelling in one or other thigh, a moderate or slight rise of temperature, and in acute pain. He was admitted to the ward, an X ray examination was made, and the abscess was opened. Only once in several years had a sequestrum been seen radiographically and removed. Both shafts showed general thickening with no sign of obviously active trouble. The pus having been evacuated, the wound was drained for a very short time and then closed, and the patient had several months of good health. The infecting organism was a staphylococcus. Last year this process had been gone through and the wound of the latest incision—this time in the lower third of the right thigh—had apparently been going through the normal settling down process when suddenly the knee became acutely painful, swollen and tense, with synovial effusion. Aspiration removed a large quantity of turbid fluid, and through the syringe the joint was flushed repeatedly with saline solution. Culture yielded a pure streptococcus. The aspiration and flushing were repeated several times, but each time the fluid was more frankly purulent. The knee joint was widely opened and also abscesses which had formed under the quadriceps

and in the leg, the capsule having given way before the acuteness of the infection. The patient's temperature had been raised and the pulse rapid, and he looked desperately ill. The limb was suspended with weight extension, but every movement, however slight, caused suffering. His condition rapidly became worse and a bed sore developed. The question of amputation as a means of saving life had to be faced. As a last attempt to save the limb (and possibly life too) a plaster of Paris cast was applied from the base of the toes to the groin. Simply ignoring the discharging wounds, which were covered only by moderate dressing pads, the limb in the cast was suspended from the Balkan frame. The change in the patient's comfort was immediate. He began to take food and sleep, and his chart showed definite improvement in temperature and pulse. His bedsores began to heal, as it was now possible to attend to him without movement and pain at the knee. Very soon the cast became stained by discharge and pus dripped out at the proximal end, the foot being elevated. A basin was placed to receive this and the cast was changed only when the odour and general unpleasantness became great enough to inconvenience the patient himself and those near him (about ten days). Under this régime, and with several changes of plaster, the intervals between changing becoming longer as the discharge lessened, the condition of the leg cleared up completely and the patient now had a sound limb with a stiff joint.

An interesting feature of this case was the streptococcal joint infection. Either the knee had been infected by a blood-borne organism or by direct extension from the adjacent bone focus of a mixed infection. The immediate improvement in the patient's general condition on application of the plaster cast had been most noticeable and was another example of the value of complete rest to tissues fighting infection. It was hard to appreciate this tremendously important principle, which was the foundation of the Winnett-Orr method, although one became accustomed to make use of it in osteomyelitis. It was, however, by no means limited to this condition, but was universally true. The difficulty was to apply it in many cases.

Another example of its efficacy had occurred not long after the one just quoted. This knee joint had not been connected with bone infection, but a penetrating wound by a septic tooth caused acute arthritis. The patient, a youngster of fourteen years, became very ill and the joint had been opened and drained in several places. Consultants advised amputation to save life, but a series of immobilizing plasters, as before, gave the tissues just the rest they needed to enable them to overcome the infection, instead of having their carefully prepared defences broken down and destroyed by oft-repeated small traumata of movement and changing of dressings. Here again the most striking thing was the immediate change in the patient's general condition. Sleep and appetite returned and the boy lost the harassed, hunted look, and the temperature and pulse steadied. This boy had a sound, though stiff-kneed, lower extremity.

Although a joint infection in association with osteomyelitis generally resulted in loss of function, it was not always the case.

Dr. Hoets had been asked to see a lad of eleven years, sent from the country with an osteomyelitis of the upper end of the humerus. Infection had spread to the joint, which already was badly damaged on X ray evidence. At operation the upper end of the bone was exposed and the shoulder joint opened. It was full of pus. Drill holes were placed to the limit of the infected area, and the wound, including the shoulder joint, was filled with a vaseline gauze plug; the arm was placed in about 60° abduction and a plaster cast was applied, including the upper limb and trunk. To avoid the necessity of changing this cast, a window was cut and pads were changed as they became soaked, but the vaseline pack was left *in situ* for about six weeks, when it was changed. Some three months later a sequestrum was removed and the wound soon closed. The boy had a surprisingly good range of true shoulder movement.

Apart from the surgical treatment of acute infections the most important thing was to place the limb in a good functioning position and to keep it at rest. In many

cases plaster casts were ideal; in others they were not so good; and weight extension with the part suspended might recommend itself. At any rate there should always be kept in mind these two factors in treatment—first and all the time, rest; secondly, a position which, if the patient recovered, would be one of useful function, even if the joint was stiff. At times it was practically impossible to maintain or, rather, to secure the optimum position. Particularly was this so when the patient was seen late in the disease, when dislocation had occurred and more than one joint was involved. The patient's condition might be so bad that any attempt to reduce the deformity would not be tolerated on account of the pain caused in the attempt. It was under such conditions that one must be content to maintain tissue rest, even though joints became fixed in some horrible position, and to save life at the expense of function. It was very humiliating to have these deformities constantly under one's eyes, but one could take comfort in the thought that if the patient had been seen earlier such faulty positions would not have occurred. When the patient was seen early, the maintenance of good position by cast or traction was also the position of greatest comfort.

In conclusion, Dr. Hoets referred to the Winnett-Orr method of treatment, which was often even now misunderstood. One heard it called "the sealing up" method. This was, of course, an absolutely false idea. The wound was filled with a pack of vaseline gauze or Albee's modification—a mixture of six parts of hard paraffin to four parts of soft. This mixture set firm at body temperature and so might be poured into the cavity in its melted state; there it set, forming a perfect pack, filling the wound completely. The wax would not stick to the tissues as gauze would, and so there was always a channel between the pack and the wound walls—soon covered by healthy granulations—for the easy escape of any discharge. In other words, there was perfect drainage combined with rest by the cast, which immobilized the limb. Perfect rest and drainage were very different from sealing up—the discharge was received into dressing and cast, which sopped it up, but the discharge was not retained in the tissues. When a dressing was changed the wax pack was lifted out easily, no adhesions being possible; the wound was a beautiful sight, the cavity being completely lined with healthy pink granulations; not one was broken or torn, and no not a speck of blood was seen, and no absorption of toxins took place from a raw surface.

Dr. B. T. EDEY said that the subject was one that had always interested him, not so much in children as in adults. In adults his experience was that if the knee joint became infected in association with osteomyelitis, it almost always meant the loss of the limb in order to save the patient's life. If there was osteomyelitis of the lower end of the femur and the knee joint became involved, it was sometimes doubtful whether the condition was a joint infection or merely a serous effusion. In such instances, to establish a diagnosis, fluid was withdrawn and a bacteriological examination was made. The fluid might be found at first to be clear; but the joint would fill again and the fluid withdrawn later might be found to be cloudy and to contain streptococci or staphylococci. The question then was what was to be done. Dr. Edey usually washed out the joint with a 1 in 1,000 solution of acriflavine. But generally the effusion recurred and it was necessary to decide to open the joint, and to open it freely; everything possible was done to save the limb. These measures might give respite for a while. But the infection would probably then appear behind the joint, in the calf or the thigh, and the patient would be seen to be very ill and his condition to be deteriorating. Finally amputation would be necessary. This applied particularly to the knee joint; Dr. Edey had not had such wide experience with other joints. He came to the conclusion that if it were possible to persuade people, it would be better to amputate earlier and to save much suffering and perhaps the life of the patient. Perhaps the failure to save limbs might be because the joint was not sufficiently immobilized, as emphasized by Dr. Hoets. In the early stages of the War lives were sometimes lost by delaying amputation in an effort to save limbs. Finally

it became a general rule to amputate early, with the result that many more lives were saved, though perhaps some limbs were sacrificed.

Dr. Edey spoke of the wonderful resisting powers of children. Even when joints were full of pus recovery would follow on their being washed out. Adults did not respond so well and more drastic measures were necessary.

In conclusion, Dr. Edey thanked the readers of the papers.

Dr. W. VICKERS thanked the speakers for their papers. Dr. Smith had traversed the methods of joint infection and had led on to the question of treatment. Dr. Vickers thought that in some ways Dr. Smith had been too pessimistic. One reason for the bad results obtained was that the surgeon did not as a rule see the patient sufficiently early. Dr. Vickers wished to emphasize that the most essential factor in treatment of infected joints was complete rest. That was where they failed. If the patient came under treatment early it was mostly possible to apply traction and to immobilize the limb in such a way that the child was made more comfortable with such an application than without it. If immobilization was complete, it made the patient comfortable, not uncomfortable. But if the patient had been allowed to go without immobilization for a fortnight or three weeks it was difficult to prevent the deformity from getting greater.

Dr. Vickers mentioned a case in which the epiphysis was detached as a result of damage done to it by being allowed to lie in pus with an intermittent pull of the muscles upwards. This pull separated the muscles from the shaft. If the joint remained full of pus, with the swelling of the capsule dislocation backwards occurred. The child was sometimes so ill that when the surgeon attempted to apply strapping there was such damage to the skin that he was forced to let it go. But when the child was not made comfortable it was sometimes the surgeon's fault.

In regard to splinting, with the Thomas's modified splint it was possible to fix the splint above and below the site of injury. The slings at this site could be removed for dressing. But if the limb was embedded in plaster and there was no movement, dressing being also carried out without movement, then the immobilization was certainly more efficient. Dr. Vickers spoke of allowing the limb to remain without dressing. In these circumstances, if the limb was completely at rest it could be allowed to work out its own salvation. The more they studied osteomyelitis, the more it was realized that rest was the essential thing.

In regard to knee joints, it was very rarely necessary (in children) to amputate for osteomyelitis or for septic knee joint. Knee joints were more frequently stiff from osteomyelitis round the joint, because they were so much bound down as a result of sepsis. Dr. Vickers spoke of the operation for lengthening of the quadriceps and said that it was possible to get a reasonable range of movement.

In regard to the hip joint, Dr. Vickers said that extension would save the limb if both legs were fixed and wide abduction was maintained. Occasionally a good movable joint was the result. He referred to a boy who had had a pneumococcal infection of the hip joint and who was running about at the end of two months.

Dr. Vickers said that the nature of the infecting organism was important. With a streptococcal infection, especially of the knee joint, washing out the joint cavity with a large quantity of saline solution, after an opening had been made into the supralateral area at the side of the patella, was all that was necessary. With a staphylococcal infection, however, there was more destruction of cartilage.

Dr. V. J. KINSELLA thanked the speakers for their papers. He wished to describe a case of particular interest, in the hope that some light might be thrown on the problem that it presented. The case was one of osteomyelitis and had exercised the minds of many of his colleagues before the patient died. The patient had been admitted to hospital with severe pain over the upper part of the fibula of four days' duration. Sedatives were given, but with no effect. The patient was in agony. The signs were found to be localized in the head of the fibula; the parts were

swollen, red, oedematous and extremely tender. The patient was a young married woman of twenty-eight years. There was nothing relevant in the history except a vaginal discharge. The condition was thought to be osteomyelitis at the upper end of the fibula, but the discharge suggested that a gonococcal fibrositis might be present. The temperature was high. At operation the tissues were found to be oedematous, the muscles were separated from the fibula, and turbid fluid flowed into the wound. The fibula was drilled, but nothing came away. Vaseline was put into the wound, the limb was enclosed in plaster and the patient was put back to bed. The pain was not relieved, the temperature was still high. A couple of weeks later the popliteal space was explored, but no pus was found; and the lower end of the femur was drilled and still no pus was found. Various methods of splinting the limb were tried, but the patient's pain was still extreme. Two weeks later an X ray picture showed a change in the bone in the head of the fibula and the adjacent part of the tibia. The drill holes had evidently been below the site of the trouble. The affected head of the fibula was removed and the incision was deepened into the shaft of the tibia; a little pus was found infiltrating the cancellous bone, and the bone was seen to be decalcified. This bone was soft and easily scraped out. A little thick pus was found in the anterior tibial compartment. An incision had now been made from the thigh to the ankle, and it was felt that the condition of the limb should improve after the finding of pus. The wound was again filled with vaseline, the limb put in plaster and the patient was put back to bed. Three weeks later an X ray picture showed changes in the soft parts which were seen to be partly calcified. The patient's temperature came down for days at a time and the incision began to heal. But the pain persisted. Bony crepitus was felt when the hand was placed on the knee joint. Now, when the patient had been in hospital for three months, the possibility of relieving the pain by radiotherapy was considered. It was thought that even if the inflammation were stirred up by the radiotherapy the leg could be amputated. Radiotherapy was completed. A few days later the patient became comatose and died. At the *post mortem* examination the tissues and bones were examined by Dr. Tebbutt macroscopically and microscopically, and the findings suggested that the bone condition was healing up. The bone was decalcified, but there was no pus or sarcoma. One curious thing was the condition of the knee joint. The infection had invaded the knee joint, but there was no fluid; however, the cartilages were softened and eroded over the points of pressure. This was more pronounced over the patellar surface of the lower end of the femur. The semilunar cartilages had almost disappeared. The cause of death was a streptococcal meningitis. Dr. Kinsella remarked that the patient had been incooperative and would not allow herself to be touched or moved, and decubitus ulcer developed in spite of the most careful and skilled nursing. The pelvic organs were found to be normal. An interesting feature was that the blood count revealed that the leucocytes did not rise above 14,000 per cubic millimetre. Other laboratory tests (Wassermann, Widal, the complement fixation test for the gonococcus) yielded no reactions. Swabbings had not been taken from the wound at the time; this part of the investigation was unsatisfactory. After operation swabbings showed only staphylococci and *Bacillus coli communis*, and later *Bacillus pyocyaneus*. Dr. Kinsella had never seen a case like this one, with such severe and constant pain and such dryness of inflammation, while the patient's general appearance and colour and nutrition had been good. In conclusion, Dr. Kinsella said that he would be grateful to hear any opinions or suggestions from the members present.

Dr. W. C. PETHERBRIDGE mentioned cases of pneumococcal joints in which exploratory puncture and rest had been followed by recovery. Dr. Hoets had referred to bacteriological investigation in such cases, and Dr. Petherbridge thought that the initial bacteriological investigation was very important, because, if it was possible to say that the infection was of low virulence, as from the pneumococcus or *Staphylococcus albus*, and if the patient's condition was

good, then it was possible to adhere to conservative treatment and get good results.

Nearly all joint infections came from a general infection of the blood stream, so that, apart from the focus, the general infection must be treated. In children benefit might or might not be derived from serum and vaccine treatment; it was impossible, however, to overstress the importance of good feeding and hygiene. When the child was trussed up in splints, it was often not given enough sun and air. For this reason it was sometimes found that the best of nursing did not achieve such good results as were seen in sanatoria where there were more air and sunlight. In regard to the mobilization of a joint when it was thought to be all right, Dr. Petherbridge spoke of the risk of waking up the infection and setting up inflammation that might prove troublesome. He would like to hear the opinion of the meeting in this connexion.

Dr. F. C. ROGERS thought that the crux of the matter was the question of immobilization of the joint. The patient must be very ill indeed if immobilization was not to be practised. Dr. Rogers spoke of a girl who had been sent from the country, moribund, with osteomyelitis of the pelvis and hip joint; there was pathological dorsal dislocation of the hip and three inches of shortening. This patient was put on a Hamilton splint with weight extension, which he was still old-fashioned enough to use, and kept in abduction. She now had a useful leg. Such patients must have rest. In all ordinary cases of osteomyelitis, for example of the tibia, it was well to put the surrounding joints into the position in which they would be of most value to the patient if any ankylosis should occur.

Dr. Keith Smith, in reply, said that not very many controversial points had arisen in the discussion. Concerning Dr. Edye's remarks about the involvement of the knee joint in osteomyelitis of the lower end of the femur, Dr. Smith said that as far as his experience went it was as uncommon as was the problem of amputation in childhood.

Dr. Vickers suggested that he had been unduly pessimistic regarding the outcome of these cases. He should remember that they were dealing with the *Staphylococcus aureus*, the greatest enemy of childhood. With the pneumococcus it was possible to take more liberties; surgical requirements were less exacting and in children there was no need for such drastic measures of incision and drainage as in adults.

In regard to rest, Dr. Smith said he was a convert to the Winnett-Orr treatment. This treatment had been called the "sealing-up treatment"; but in reality it was the antithesis of this. It was the gospel of adequate rest and drainage. Dr. Smith had met with minor difficulties in this treatment, such as the occurrence of hæmorrhage under the plaster cast. Also in cases of osteomyelitis there were often multiple foci. The development of a secondary undetected focus, with the resultant signs of fever and so forth, would cause one to be apprehensive as to whether all was well under the chart.

Dr. Kinsella's case was a most interesting and puzzling one. Perhaps it was a septicæmic epiphysitis. There was involvement of the knee joint and therefore the organisms were in a good position to invade it.

Replying to Dr. Petherbridge, Dr. Smith said that the *Staphylococcus aureus* was very dangerous compared with the pneumococcus. In the latter infection they could look for a happy outcome for the joint. It was difficult to know when to start immobilizing a joint. Dr. Smith himself had at times made the mistake of attempting too early immobilization.

In Dr. Smith's opinion the Hamilton splint was a very exiguous type of corrective apparatus. The patient wearing it could undertake every outdoor pastime, except perhaps football. It imposed a certain restraint, but was not a very valuable immobilizing agent; it did not quite meet the situation.

Dr. Hoets, in reply, wished to correct a wrong impression that he had apparently given. In speaking of posture in infected cases he did not mean that the limb should not be put in good position. He meant that when the patient was very ill it was at times impossible to obtain a good

position and hold it. But this did not apply to early cases. Rest in good position gave comfort.

Dr. Petherbridge had spoken of putting the patient under good hygienic conditions. But did exposure to sun and wind necessarily constitute good hygienic surroundings? He quoted Allison in regard to tuberculous joints treated by Rollier's method. An interesting series of experiments was carried out. Patients were divided into three lots. One followed Rollier's technique, being much sunned and living largely out of doors; another series was kept in the wards and on the verandas when the weather was suitable; a third series was allowed to do just what they liked. It was found that the third series, doing what was most pleasant to them, did best of all.

Correspondence.

SERUM TREATMENT OF POLIOMYELITIS.

SIR: Your issue of September 21 includes a paper by Dr. Jean Macnamara upon the early treatment of poliomyelitis, which was read at a meeting of the Neurological Section of the Victorian Branch on May 9, 1935.

The paper contains the following statement: "If one decides to obtain serum from any volunteer such as the parking attendants bled recently by the Victorian Poliomyelitis Committee, rather than to take the trouble to locate recently paralysed patients . . . many patients will develop paralysis; but it is hardly fair to blame serum for the results or to assume that because one's serum is poor stuff, that prepared elsewhere is equally poor."

On behalf of the Victorian Poliomyelitis Committee I wish to state that the Committee has prepared, in addition to human immune serum, various batches of pooled normal serum from young adults, but that this has not been done in order to avoid the trouble of locating recently paralysed patients. It is a fact furthermore that recently, subsequent to May 9, 1935, there have been included among our donors a number of parking attendants all of whom are particularly healthy and vigorous men. This normal serum has, of course, never been classed as human immune serum.

There is good reason to believe that the pooled normal serum of young adults living in an infected community has about half the virucidal power possessed by convalescent serum, and a small number of early cases of poliomyelitis have been treated with this pooled normal serum with results indistinguishable from those which have followed the use of convalescent serum. The Committee believes that if this serum can be shown to be as effective as the latter serum, the early treatment of the disease would be freed from many of the embarrassing restrictions necessarily associated with the use of convalescent serum, the supplies of which are likely, under any circumstances, to be limited in amount.

With reference to Dr. Macnamara's statement, unaccompanied by any details of cases, that human immune serum supplied by the Committee failed to bring about a fall of temperature in recent cases until 250 cubic centimetres had been given, and the inference that the serum prepared by herself was much more effective, my Committee has received reports of all the cases notified to the Health Department in the recent outbreak in the western district. Some of these were treated with the usual doses and some with doses smaller than usual of the batch of human immune serum in question, and according to the reports the results were quite satisfactory. Of 23 cases which received serum, 17 were treated before any paralysis was detected, and of these four developed some paralysis and are now said to be improving.

Six cases received serum after the development of paralysis, and of these one is said to have recovered and the others to be improving.

Of the 23 cases only five received more than 100 cubic centimetres of serum.

Yours, etc.,

J. DALE,

Medical Officer of Health and
Chairman of the Medical
Committee Controlling the
Poliomyelitis Campaign.

Melbourne,
September 30, 1935.

Proceedings of the Australian Medical Boards.

VICTORIA.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Act*, 1928, of Victoria, as duly qualified medical practitioners:

Biggs, Frank Eric Raymond, M.B., Ch.M., 1917 (Univ. Sydney), 48, Queen Street, Bendigo.

Forster, Cameron McDougall, M.B., Ch.M., 1926 (Univ. Sydney), 95A, Mathoura Road, Toorak, S.E.2.

Franklands, Herbert Malcolm, M.B., B.S., 1934 (Univ. Melbourne), 131, Orrong Road, Toorak, S.E.2.

Melville, Alexander Hugh, M.B., Ch.B., 1914 (Univ. Melbourne), Repatriation Commission, St. Kilda Road, Melbourne.

Rolph, William Henry, M.B., B.S., 1935 (Univ. Melbourne), 3, Blyth Street, Brunswick, N.10.

TASMANIA.

THE undermentioned has been registered, pursuant to the provisions of the *Medical Act*, 1918, of Tasmania, as a duly qualified medical practitioner:

Dyring, Valdemar Carl, M.B., B.S., 1925 (Univ. Melbourne), Latrobe.

QUEENSLAND.

THE undermentioned have been registered, pursuant to the provisions of *The Medical Acts*, 1925 to 1933, of Queensland, as duly qualified medical practitioners:

Devenish-Meares, Molly Constance, M.B., 1931 (Univ. Sydney), Emerald.

Fitzgerald, Leo Joseph, M.B., B.S., 1933 (Univ. Melbourne), Nanango.

Rosen, Eric Nathan, M.B., B.S., 1931 (Univ. Sydney), Bundaberg.

NEW SOUTH WALES.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Act*, 1912 and 1915, of New South Wales, as duly qualified medical practitioners.

Alexander, Mary Elizabeth, M.B., Ch.B., 1933 (Edinburgh), c.o. J. B. Nicholson, 418, Edgecliff Road, Woollahra.

Panting, Arthur Ernest, M.B. et Ch.B., 1915 (Univ. Melbourne), 157, Macquarie Street, Sydney.

Diary for the Month.

- Nov. 4.—New South Wales Branch, B.M.A.: Organization and Science Committee.
 Nov. 5.—Tasmanian Branch, B.M.A.: Council.
 Nov. 6.—Western Australian Branch, B.M.A.: Council.
 Nov. 7.—South Australian Branch, B.M.A.: Council.
 Nov. 8.—Queensland Branch, B.M.A.: Council.
 Nov. 12.—Tasmanian Branch, B.M.A.: Branch.
 Nov. 12.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
 Nov. 13.—Victorian Branch, B.M.A.: Branch.
 Nov. 19.—Tasmanian Branch, B.M.A.: Council.
 Nov. 19.—New South Wales Branch, B.M.A.: Ethics Committee.
 Nov. 20.—Western Australian Branch, B.M.A.: Branch.
 Nov. 20.—Victorian Branch, B.M.A.: Clinical Meeting.
 Nov. 21.—New South Wales Branch, B.M.A.: Clinical Meeting.
 Nov. 22.—Queensland Branch, B.M.A.: Council.
 Nov. 23.—Victorian Branch, B.M.A.: Country Branch Meeting (Horsham).
 Nov. 26.—New South Wales Branch, B.M.A.: Medical Politics Committee.
 Nov. 27.—Victorian Branch, B.M.A.: Council.
 Nov. 28.—South Australian Branch, B.M.A.: Branch.
 Nov. 28.—New South Wales Branch, B.M.A.: Branch.

Medical Appointments.

Dr. R. J. Aitchison (B.M.A.) has been appointed a Certifying Medical Practitioner at North Brighton, Victoria, pursuant to the provisions of the *Workers' Compensation Act, 1928*.

Dr. W. F. Joynt (B.M.A.) has been appointed Honorary Surgeon to the Barmera Hospital, South Australia.

Dr. H. L. Carruthers has been appointed to act as Medical Inspector of Seamen and Medical Inspector of Shipping for the purposes of the *Navigation Act, 1912 to 1934*, and as a Quarantine Officer for the purposes of the *Quarantine Act, 1908 to 1924*.

Dr. C. L. Anderson (B.M.A.) has been appointed a Quarantine Officer at Broome, Western Australia, under the *Quarantine Act, 1908 to 1924*.

Dr. G. V. Davies (B.M.A.) has been appointed a Certifying Medical Practitioner at Wangaratta, Victoria, pursuant to the provisions of the *Workers' Compensation Act, 1928*.

Dr. L. M. Snow (B.M.A.) has been appointed Government Medical Officer at Tamworth, New South Wales.

Dr. A. E. Colvin (B.M.A.) has been appointed a Member of the Board of Official Visitors to the Mental Hospital at Orange, New South Wales.

Dr. A. W. Krichauff has been appointed a Resident Medical Officer at the Adelaide Hospital, South Australia.

Dr. J. H. Blackburn (B.M.A.) has been appointed Superintendent, Westwood Sanatorium, Queensland, in pursuance of the provisions of the *Public Service Acts, 1922 to 1924*.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, locum tenentes sought, etc., see "Advertiser", pages xx, xxi, xxii.

LAUNCESTON PUBLIC HOSPITAL, LAUNCESTON, TASMANIA: Resident Medical Officer.

QUEEN'S MEMORIAL INFECTIOUS DISEASES HOSPITAL, FAIRFIELD, VICTORIA: Consultant Surgeon, Junior Resident Medical Officer.

THE UNIVERSITY OF MELBOURNE, VICTORIA: Stewart Lectureship in Surgery, Senior Lectureship in Anatomy.

THE WOMEN'S HOSPITAL, CROWN STREET, SYDNEY, NEW SOUTH WALES: Junior Resident Medical Officers.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCH.	APPOINTMENTS.
	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmmain United Friendly Societies' Dispensary.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phoenix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Brisbane Associate Friendly Societies' Medical Institute. Chillagoe Hospital. Members accepting LODGE appointment and those desiring to accept appointments to any COUNTRY HOSPITAL, are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Editorial Notices.

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